The Dock and Harbour Authority

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Editorial Comments

New Year.

The change in the Calendar affords us the opportunity of wishing our readers " A Happy New Year," a greeting given in all sincerity and with the sober expectancy that 1941 will bring about in a very substantial measure, if not entirely, a dispersal of the clouds which have lowered over the country for so long a time.

For many ports in Great Britain, as also for an even greater number on the Continent of Europe, the past twelve months has been a record of unbridled and wanton destruction. Not only has trade been serious disturbed and, in some cases, practically extinguished, but the fabric of the ports has suffered tremendous physical havoc. Quays, with their valuable mechanical equipment, have been demolished, wharves and jetties blown up, sheds and warehouses burned out and whole port districts left a mass of ruins and a scene of utter devastation. Such are the results of the efforts of Nazis to establish " a new order " in Europe; a story of which civilisation and humanity will for ever be ashamed. The Nazi mentality is such that it would be idle to expect to see any sign of real contrition or remorse on the part of the German people for the grief and misery which, in their insane lust for blood and conquest they have inflicted on the whole of Christendom; but there must undoubtedly come a time when they will realise the truth of the old proverb: Ill deeds never prosper.

Meanwhile, it is the duty of everybody in this country to face the future with calm and resolute courage, confident in the ultimate issue and so we repeat the cheering message, A Happy New Year!

An Equatorial Harbour.

In the Southernmost extremity of the vast region known as French Equatorial Africa, where it borders on the Belgian Congo, lies the port of Pointe-Noire, which forms the subject of this month's leading article. The port is a modern creation, brought into existence by the rapid development and exploitation by the French of their richly productive possessions in this part of the world. Lavishly endowed by Nature, and possessing extensive tracts of forest and luxuriant vegetation, rubber, ivory, palm-oil, coffee, etc., are some of the leading products of a region, formerly little known, but now brought prominently into notice by reason of its contributions to the stream of world commerce. The internal and external communications are of the best. The river Congo, to the mouth of which Pointe-Noire is closely adjacent, provides a navigable highway reaching far into the interior of the country; in addition there are two railway lines with termini respectively at Leopoldville and Brazzaville, the one in Belgian and the other in French territory.

The possibilities of successful commercial development being so marked, it is only natural that every effort should be made to provide on this part of the coast, a safe and convenient harbour, which would enable shipping to avoid the local inconvenience of the " barre." As pointed out in the article, which we are privileged to translate and reproduce from the French technical journal *Travaux*, until quite recently a journey to the banks of the Congo was an expedition involving some difficulty; now, it can be accomplished with ease and comfort. Our readers will concur in the opinion expressed in the article that the geographical importance of the position of Pointe-Noire constitutes a guarantee for the future prosperity of its well-appointed harbour and port.

Port Authorities—in Great Britain and the U.S.A.

The title " Port Authority " is nowadays a familiar one and, being convenient, it is frequently used as a general designation for bodies, whatever their individual title, who are concerned with the administration of ports. The name is, however, of quite modern origin, having been first officially bestowed on the body which, in 1909, was formed out of an amalgamation of previously competitive interests, to rule the destinies of the Port of London. The story of its apt invention is told by Mr. Julius Cohen in the interesting address which he delivered at the New York University School of Law, reproduced in this issue. The late Lord Devonport having vouched for the authenticity of the anecdote, there is no ground for questioning its reliability. It must be avowed that the title is singularly appropriate and effective, being both comprehensive and dignified. No surprise need be felt that, a dozen years afterwards, the Port of New York saw fit to adopt it for a generally similar, but not absolutely identical, purpose.

It is unquestionably interesting to investigate the origin of official designations, especially in so far as they throw light on the essential significance of the things to which they refer, and, in discussing the evolution of the idea implicit in the titles of the two greatest ports of the world, Mr. Cohen has rendered a useful service for students of port affairs.

As we have pointed out, although the titles of the two great governing bodies are alike, their functions, despite a general similarity in certain important respects, are not precisely the same. The jurisdiction of the New York Authority is extensive and at the same time compact. It covers some 1,500 square miles of territory and controls not only shipping facilities and commercial transactions, but the operation of railway lines, the construction of bridges and tunnels, the regulation of traffic and a number of other things associated in Great Britain with municipal administration. Principally, however, its energies are directed to the study of the needs of transport in and through the port area, and to the promotion of schemes for the development of traffic facilities, whether by road, rail or water. It has certain limitations. It does not own or control the " docks " (i.e., in English terminology, the piers) along the frontage of Manhattan —these are in the hands of the Commission of Docks of New York City. Pilotage is separately supervised by Boards of Commissioners of the States of New York and New Jersey. There is a Harbour Supervisor, appointed by the President of the United States, and acting under the direction of the Secretary for War, who safeguards the harbour waters from illegal dumping of refuse, and a Captain of the Port, also a Federal official, who assigns anchorages and berths, supervises the handling of explosives and issues licences to stevedores. The U.S. Corps of Engineers deal with all matters affecting the maintenance and improvement of the navigable channels.

The jurisdiction of the Port of London Authority is less superficially extensive and is territorially more scattered. Its local control, however, is more effective. It owns and administers the whole of the disconnected dock systems (with one trifling exception) on both sides of the Thames. On the other hand, with the exception of a cargo jetty at Tilbury, it does not own or control the riverside wharves, though it exercises a veto over structural alterations and additions thereto. The wharves are in private hands. In regard to the river, Trinity House is, to a certain extent, a co-administrative body, i.e., as regards

Editorial Comments—*continued*

lighting and buoyage, while the Thames Conservancy and the London County Council loom in the background with corporate interests of their own. The Authority, in fact, may be said to own the bed but not the banks of the Thames Estuary. It dredges and deepens the navigable channel, raises wrecks and removes obstructions, makes byelaws for regulating traffic and preventing pollution and it licences lightermen and watermen, but it does not provide the river police, pilots or sanitary or medical inspection. A further important function of the Authority is that of warehousing and storage.

These few facts go to show the very different conception of the duties of a " port authority " as applied to the leading ports of Great Britain and the United States. Mr. Cohen's exposition of the application of the term in the case of New York should be read with interest and profit by port officials on this side of the Atlantic.

Quayside Troubles.

There has been a painful and disturbing revelation in the press lately that a growing lack of push and energy on the part of dock labour is manifesting itself in the handling of goods at the quayside of the major British ports. More painful and even distressing it is to learn the cause of the trouble. To quote from the account given in a recent issue of a well-known shipping journal: " many of the men seem convinced that the shipowners are making money, and they believe that the industry can afford to pay them more. That is a view not restricted to shipping, but is widely held among ship-building and engineering workers who are continuing to press for an increase in pay." If this be a fair statement of the case and there is no pretence of insufficiency of present pay to meet increased cost of living, the attitude of labour is incomprehensibly shameful. It means that purely individualistic interests are being made to outweigh the needs of a grave national emergency and that the lives and safety of those engaged in the present titanic struggle are being hazarded and possibly sacrificed in order to provide a bargaining basis for more pay.

This is not to excuse, or defend, any alleged profit-making on the part of ship-owners and others. That question, at the moment, does not arise. The insistent fact is that, at no matter what cost to himself, it is every man's duty to do his utmost for the national cause. There must be no relaxation of effort on the part of any section of the community. If Hitler and his gang were to triumph, what would be the advantage of any paltry increment in wages? Labour would be ground down under the iron heel of the conqueror. We are all in it together—to win or go under. Let the good sense and patriotism of the dock labourer rise above purely selfish considerations.

But cargo handling troubles at the quayside are not confined to disaffection in the ranks of labour. There is another kind of vexatious delay due not to monetary considerations, but, no less unfortunately, to bad management and defective staff work. In a leading article in *The Daily Telegraph* on December 12th, a " Shipping Correspondent " makes the serious charge that " the shipping industry, under the Ministry, is proving incapable of coping with war-time urgencies and complexities." The following was given as an example. A steamer was recently discharging steel billets in a British port. The billets, normally from 10 to 20-ft. in length, were being loaded into railway wagons on the quay. All went moderately well (no overtime was worked) until some 25-ft. billets were reached, for which specially long wagons were needed, and these not having been requisitioned, were not forthcoming. The unloading process accordingly had to be slowed down and, altogether, between 3 and 4 days were lost through neglect to have proper rolling stock in readiness.

The writer of the article blames the ship's agents at the port for the delay. They had, he says, received a manifest of the cargo, together with a stowage plan, several days before the ship arrived, and they could have estimated very accurately the number of long wagons required and the precise period of requirement. The railway company could not be expected to order the disposition of their rolling stock to suit the convenience of the ship's agents.

He gave other examples of " bad staff work ": ships waiting for bunkers with no coal supplies at hand; coal waiting for ships and no labour available to trim it into bunkers; a sudden demand for sand ballast at a particular port running it short of supplies, and so causing delay to vessels otherwise ready to sail; and so on.

All these instances of inefficiency are not only regrettable in themselves, but they point to a lack of co-ordination in management which is highly reprehensible, since failure to exercise common sense and prudent foresight might well prove disastrous in the hour of a nation's peril.

The Indianisation of Indian Port Trusts.

The agitation promoted by the Indian Congress for independent self-government in India is having a collateral effect in fostering a movement for predominant, if not exclusive, native representation on Indian Port Trusts. According to advices received from India, this question is now very much to the fore, despite the reluctance of the Government to deal with it during war time. Lately, a memorial from the Federation of Indian Chambers of Commerce and Industry has been presented urging the taking of immediate steps to deal with the matter on the ground that " it is the natural right of the nationals of the country to be in charge of public administration in every sphere." Under the existing system it is claimed that Indian members of port trusts are in a minority of one to three. And, cited as a typical instance of injustice, it is complained that the Port Commissioners of Calcutta, in the face of continuous Indian opposition, refused to call for tenders for a labour contract, assigning it for over half-a-century to a non-Indian firm. Another grievance is that non-Indians are appointed to responsible positions on the Trust " disregarding the superior claims of qualified Indians."

It is, no doubt, natural for Indians to feed aggrieved at the dominance in their affairs of an alien race, but it would be unjustifiable to assume that this dominance has been exercised to the detriment of Indian interests. The contrary is, in fact, demonstrable, for India has unquestionably benefited from a long period of enlightened and settled rule. And as regards port affairs, no one would seriously maintain that there has been anything of the nature of general mismanagement and corruption. Of the particular case of partiality alleged at Calcutta, we have no means of judging for lack of information, but, even in that case, it is quite likely that there were good grounds for the policy adopted by the non-Indian majority, who, until the contrary is proved, must be considered to have acted in good faith and in the best interests of the port community, to which, in fact, they, too, belong and with which their businesses are associated.

As for the proposition that it is the natural right of the nationals of a country to be in charge of public administration in every sphere, this is plausible enough and to a certain extent may be true, but it is open to qualification in respect of special circumstances and can hardly be accepted for universal application.

Timber versus Reinforced Concrete.

As might have been expected, the article in our November issue on the relative merits of reinforced concrete and timber for jetty and wharf construction has given rise to correspondence (published in this issue) in which the writers strongly contest the arguments in favour of timber advanced by the author of the article, and in one of the letters, there is even implied an undue editorial partiality towards his case. This latter allegation does not unduly perturb us, for, as remarked in our previous Comment, the subject is undoubtedly controversial and it was only to be expected that there would be pronounced divergence of opinion. We need hardly say that the protagonists of reinforced concrete are equally welcome to the expression of their views in the columns of this Journal and our readers will be left to form their own judgment.

The reference in the article to the collapse of a reinforced concrete wharf at Auckland Harbour, N.Z., revives painful memories (since it seriously affected the health of the engineer responsible for the work) of an unfortunate incident which happened in October, 1924. A full account of the catastrophe, with correspondence thereon, appeared in our issues of December 1925, and June, 1926. Space restrictions will not admit of a full restatement of the circumstances of the case, nor of the subsequent governmental enquiry into the cause of failure, especially as the findings themselves were questioned and criticised at the time. It may briefly be stated, however, so far as the present discussion is concerned, that failure of the wharf was admittedly due to excessive lateral pressure on the piles, the originating cause of which was the main topic of controversy. The demonstrable fact was that the piles were subjected to a bending stress to which they were not equal and to resist which they had not been designed. Indeed, apart from the possibility of some slight eccentricity of loading, piles are not generally expected, unaided, to resist lateral forces producing appreciable bending moment. To this extent the argument in the article loses something of its force and cogency, though the author was justified in claiming for timber a higher degree of adaptability to the conditions which unexpectedly developed.

To sum up, both sides of the question have now been fully presented and, as stated above, readers must be left to form their own conclusions. For our part, we continue to feel that, prior to the abnormal conditions of the present war, there were insufficient grounds for a wholesale displacement in this country of timber in the construction of wharves and jetties. This does not mean that reinforced concrete cannot advantageously be employed in many situations where the conditions are suitable. Sometimes, indeed, the conditions are wholly adverse to the use of timber. Most engineers will agree that both materials have their respective spheres of utility and service.

The Port of Pointe-Noire

Construction of a New Harbour in French Equatorial Africa

(Translated from the French).

THE following account of the construction of a new French harbour in Equatorial Africa is taken from *Travaux* of May last.

The construction of the Port of Pointe-Noire (Black Point), following that of the Congo-Ocean railway, of which it is the Atlantic terminus, marks an important stage in the economic development of French Equatorial Africa.

The traveller, who, after leaving Dakar, will have traversed the calling points in the Gulf of Guinea without seeing anything but the rollers of the bar, will appreciate, on landing on a quay to enter a comfortable railway carriage which will take him in a few hours to Brazzaville, the importance of the work accomplished.

Up till recently, to reach the borders of the Congo was an expedition of some difficulty; now it is a journey, the convenience of which should logically result in a participation by territories hitherto neglected in the revival which it is to be hoped will follow the present depression.

Location and Connections

Pointe-Noire is situated on the Atlantic seaboard of an isthmus which separates the ocean from the interior sea formed by the fluvial network of the Congo. This is the cause of the geographical importance of its location, and the guarantee of the prosperity which the future has in store for the new installation.

Two railways connect the river and the sea navigation. One is the Belgian Congo Railway which was constructed between 1890 and 1896. The 380-kilometre track links Leopoldville, on the left bank of the Stanley Pool at Matadi, with the foot of the Congo Rapids. This river port, buried at the bottom of a narrow gorge, without any margin between the cliff and the river, is connected with the sea by an estuary 80 kilometres long, intersected by channels where depths of 7 metres are maintained with difficulty.

The other track, the Congo-Ocean Railway is 515 kilometres in length. It connects Brazzaville, opposite Leopoldville, with an open maritime plain, on the borders of which extend indefinitely spaces adequate for the creation of industries.

If the difference in length of track is to the advantage of the Belgian Port of Matadi, on the other hand the difficulties to be experienced in the navigation of the Maritime Congo, arising as much from the rapidity of the currents as from the insufficiency of depth, divert therefrom the vessels which cannot afford two days for the purpose of mounting the river in order to avoid the marine route.

Pointe-Noire is then the port best fitted to serve an immense hinterland, comprising the greatest part of the equatorial region nearest to Europe.

This port, situated on the Cape route to India, is a naval base of growing importance, which affords surveillance of the South Atlantic and will always be in a favourable position for policing the Gulf of Guinea.

Climatology

As regards climate, Pointe-Noire is favoured by being in the neighbourhood of a cold current of air, which, coming from the Antarctic Ocean, follows the S.W. Coast of Africa as far as Cape Lopez and cools the S.W. winds which blow in that region almost continuously.

In spite of its situation below the equator by 4° 48′ south latitude, the maximum temperature varies between 24 and 30 degrees (Centigrade) in the hot season, and it is only 16 to 26 degrees in the cold season.

The meteorological regimen comprises two seasons; a dry season lasting from June to September and a rainy season from November to April. May and October are transitional months. During the rainy season the precipitation does not exceed 1.20 metres and is concentrated during a short spell.

From an economical and juridical point of view, Pointe-Noire enjoys the system instituted in the Conventional Basin of the Congo by the Berlin Convention, which established customs equality for all nationalities and equal industrial and commercial rights for their citizens.

Description of Works

The financial credit necessary for the construction of Pointe-Noire was created by the Act of 22nd February, 1931, which authorised the Government of Equatorial Africa to issue a loan of 300 million francs for the formation of a deep water port.

In spite of a series of curtailments which have been necessary in the financial arrangements, the constructional programme of the port comprised a first expenditure on works amounting to 162,289,656 francs, including the following items:—

An external breakwater with a length of 1,750 metres.

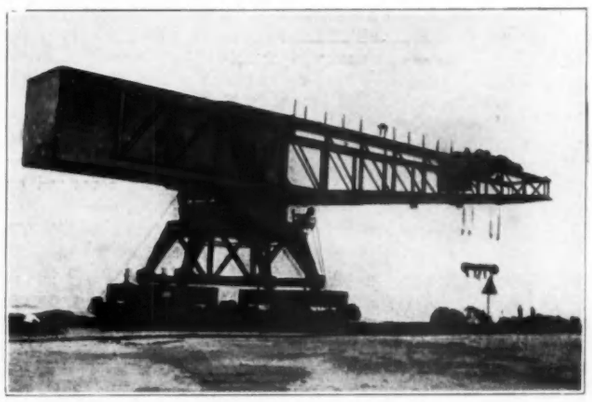
A quay wall founded at a level of 9.40 metres below low water datum, with a length of 750 metres.

A quay surface, 150 metres in mean width between these two works.

The external breakwater has its origin in alignment with the rectilinear beach which terminates at the old Pointe-Noire. It follows the rocky shallows which extend this point, then bends towards the north, keeping practically to a line 13 metres in depth.

The quay wall, which faces East, is sheltered on the North by a return wall, 250 metres long.

Between the origin of the 750 m. quay and Pointe-Noire there is provided a boat berth, 200 metres long, with 3.50 m. depth of water and a lifting slip of 500 tons.



40-ton Titan Crane used in the construction of outer Breakwater.

This group of works suffices for a temporary exploitation of the port. But, in the course of the Southern winter which lasts from May to September, swells of great magnitude are often generated by distant disturbances and these traverse the whole of the Soutn Atlantic, arriving at the African Coast, where they give rise to the phenomenon of the bar.

While the actual protective works shelter ships moored alongside the quay from the direct action of the swell, they cannot prevent the creation of oscillations in the mass of water contained between them and the line of the bay. There result therefrom alternating currents, parallel to the quays, capable of disturbing the moorings of ships and even of giving rise to damage.

The construction of an internal mole, protecting the present quay towards the East, will enable this situation to be remedied. A section of 260 metres of this work is already in course of construction, starting from the Eastern pierhead of the entrance pass.

Sand Travel

The maritime installation thus provided will have to be further protected in the near future from the invasion of sand, which travels towards the North along the whole South-West coast-line of Africa, this characteristic being general below the equator from the mouth of the Orange River to Cape Lopez. To it is attributable the formation of chains of lagoons all directed towards the South, some of them, as at Lobito, affording remarkable cover. At Pointe-Noire, it is estimated that the volume of sand annually moved by the swell and the currents amounts to 500,000 cu. m.

In point of fact, the sand is deposited along the outer breakwater, forming a bank with a crest level at about—0.50 m., and is proceeding at such a rate that the pierhead of the breakwater will be rounded in 1941.

Apparently the most suitable remedy is to promote the deposit of the sand before it passes the pierhead and so impedes the port entrance. To achieve this end, it would appear desirable to construct cross groynes, starting either at the beach to the South of Pointe-Noire or at the external breakwater itself.

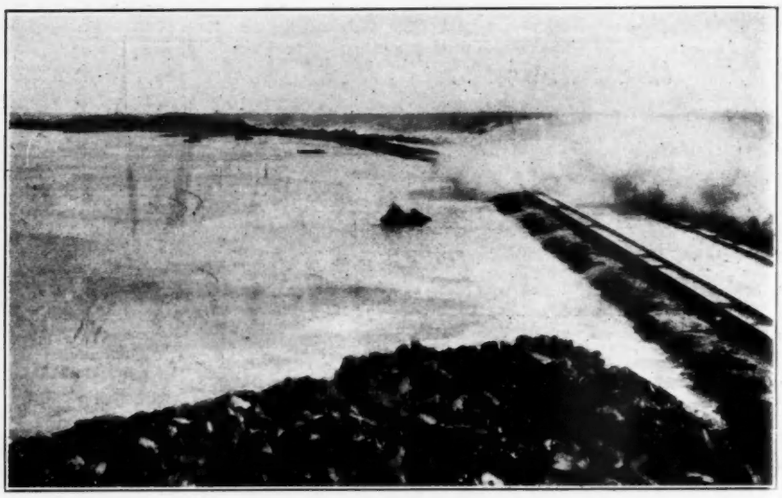
The phenomenon of sand-accumulation manifested itself from the first during steps taken for the construction of the boat

Port of Pointe Noire—continued

harbour, established in the recess of the Bay of Pointe-Noire and designed to shelter the small craft which ran a service between the shipping anchored in the roadstead and a wharf built in 1926.

The jetty protecting this little basin on the North-West was scarcely completed, before the sands which had rounded Pointe-Noire deposited themselves under the cover of this work. The sand bank so formed extended towards the South-East involving the wharf, which had to be cleared by dredging carried on until the source of the sand was cut off by the works executed for the large harbour at the end of Pointe-Noire.

In consequence of not being able to utilise the boat basin as shelter for the floating plant engaged on the construction of the large harbour, and as a discharging point for the rubble used in the formation of the sub-structure of the external breakwater, construction had to be carried out end-on by land operations.



Waves breaking on the outer Breakwater.

Breakwater Design

The discovery along the route of the Congo-Ocean Railway of quarries capable of supplying large blocks of suitable stone led to the adoption for this work of the profile shown in fig. 1. The rubble, loaded at the quarry into trucks of 12 tons capacity, was discharged by means of a Titan crane having a range of 32 metres. Natural blocks, forming a cover for the mound and having weights up to 25 tons apiece, were handled by slings and set to a slope of 5:3.

The platform of the breakwater was formed of pebble work, with a dressing of cement mortar in the joints of the rubble. The Titan track, provisionally laid on timber sleepers during the period of settlement, was afterwards permanently arranged on reinforced concrete runners constructed in place.

The construction of the internal mole was not marked by any incident except the local slipping of the protective blocks during a storm on 10th August, 1936, which led to the adoption of the profile in fig 1.

Foundations

The construction of the quay at the—9.40 m. level necessitated special precautions by reason of the existence in the foundation of beds of muddy clay capable of giving rise to appreciable settlement and also on account of the poor quality of the sand covering these beds and the slips which could result therefrom.

Experiments on models of the quay to a reduced scale made at the laboratory of the Bureau Veritas, enabled the position to be determined of the dangerous zone in which settlement was likely. In consequence of these experiments, a sectional profile was adopted for the foundation course such that the line of rupture as determined remained inside the rubble. In fig. 4 will be seen the significance of the width given to the apron and that of the thickness of the rubble in front of the toe of the quay. Thanks to these precautionary dispositions and to the graduated process of placing the filling behind the wall, no movement in the quay has been observed.

As regards the construction of the wall, this was done with the aid of a floating sheer-legs of 120 tons capacity. The blocks were piled in columns, with vertical joints every 4 metres. These blocks were hollow, the foundation and intermediate blocks having in horizontal section a T shape and the upper blocks a double T or I section on the Ravier system.

The artificial blocks for the quay wall and the other works were made in a blockyard equipped with a movable gantry of 190 tons. The concrete was mixed in a movable appliance, comprising an elevator with spouts for depositing the mix by gravity. The aggregate was passed through a crusher with sifting and grading apparatus. The stone was a granitic greiss of 2.65 sp. gr.; it was mixed with sea sand. The resultant density of the blocks was 2.5.

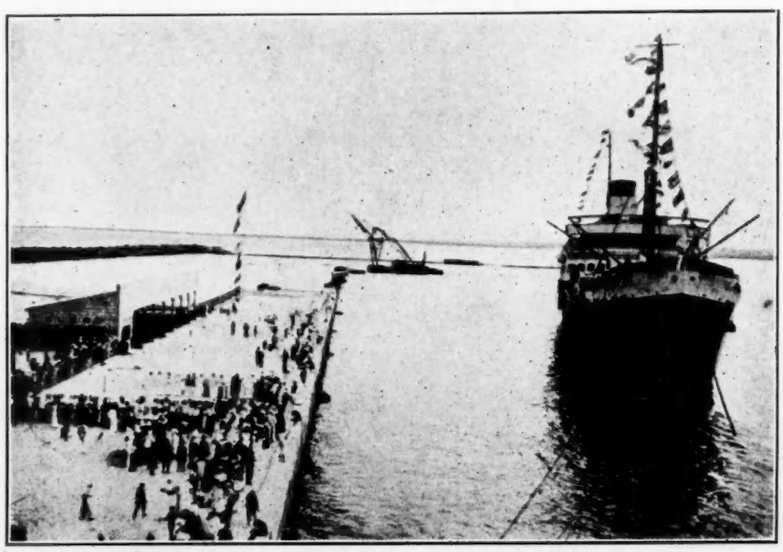
Stone Supply

Nearly 2 million tons of stone were required for the works at Pointe-Noire and the obtainment of this quantity constituted a difficult problem in a region where the depth of alteration of the rocks did not facilitate the discovery of a quarry.

The cuttings for the Congo-Ocean Railway gave no sign of sound rock, although excavated to a depth of as much as 18 metres. In the crossing of the mountainous mass of Mayombe, the artificial works were only constructed with the help of gravel collected in the water courses and it was concluded that stone did not exist in that district.

It was in contemplation, accordingly, to exploit the rocky outcrops exposed by erosion in the valleys of the Kouilou or the Congo, transport of the quarry yield to be effected by water, when a series of drillings, driven with persistence across the metamorphised rocks of Mayombe, revealed the existence of sound rock first at a point of 102 km. along the Congo-Ocean route and later at 76 km.

The metamorphic rocks, having a texture similar to marl, were removed by presses reaching sometimes to 20 metres, by means of four hydraulic monitors. Water was furnished under pressure of 5 kg. by 7 groups of motors. The rock was broken down by vertical mines in drilled boreholes. Some discharges yielded more than 100,000 tons of rock. The joint production of the quarries at the two points reached 48,000 tons per month.



View of New Quay with ss. "Foucault" (Compagnie des Chargeurs Réunis) berthing alongside.

As already indicated, there remain to be executed certain works for the closure of the basin and the complete protection of the quay (at—9.40 m.) as well as measures to arrest the sand travel which threatens to invade the new harbour.

Even as it is, with its 950-metre length of quayage, of which 725 metres afford a depth alongside of—9.40 m., the new Port of Pointe-Noire constitutes, with the Congo-Ocean Railway, a magnificent realisation of colonial activity which does honour to the spirit of enterprise manifested.

The authorities associated therewith were the Governors-General, MM. Raphael Antonetti, Renard, Reste and Boisson; the Inspectors-General, MM. Maître-Devallon, Beau, Labbé, Frazembat, Bosc and Fischer; the chiefs of the hydraulic service, MM. Nizery and Jourdain and the Engineers-in-Chief, MM. Nicolau, Lauraint and Merrat.

The contractors were the Société de Construction de Batignolles. The whole of the operations on the site were under the direction of M. Grandmaître, Ingénieur des Arts et Métiers, Divisional Superintendent of the Contracting Company.

PORT OF POINTE-NOIRE.

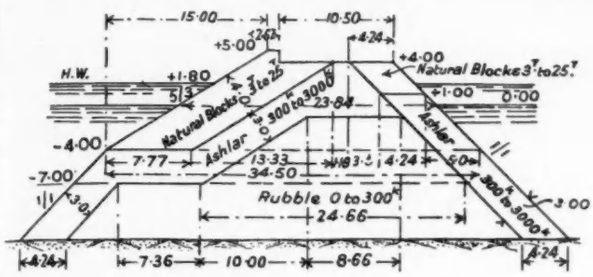


FIG. 1. EXTERNAL BREAKWATER.

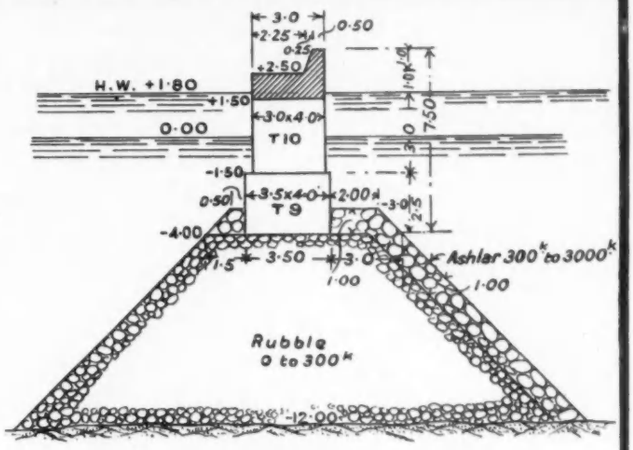


FIG. 2. INTERNAL MOLE.

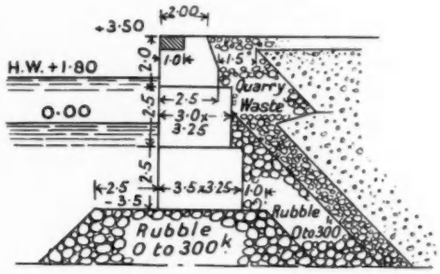


FIG. 3. SECTION OF QUAY OF BOAT BASIN.

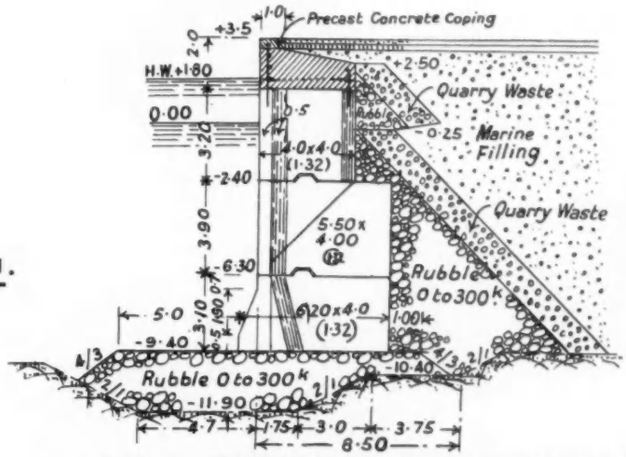
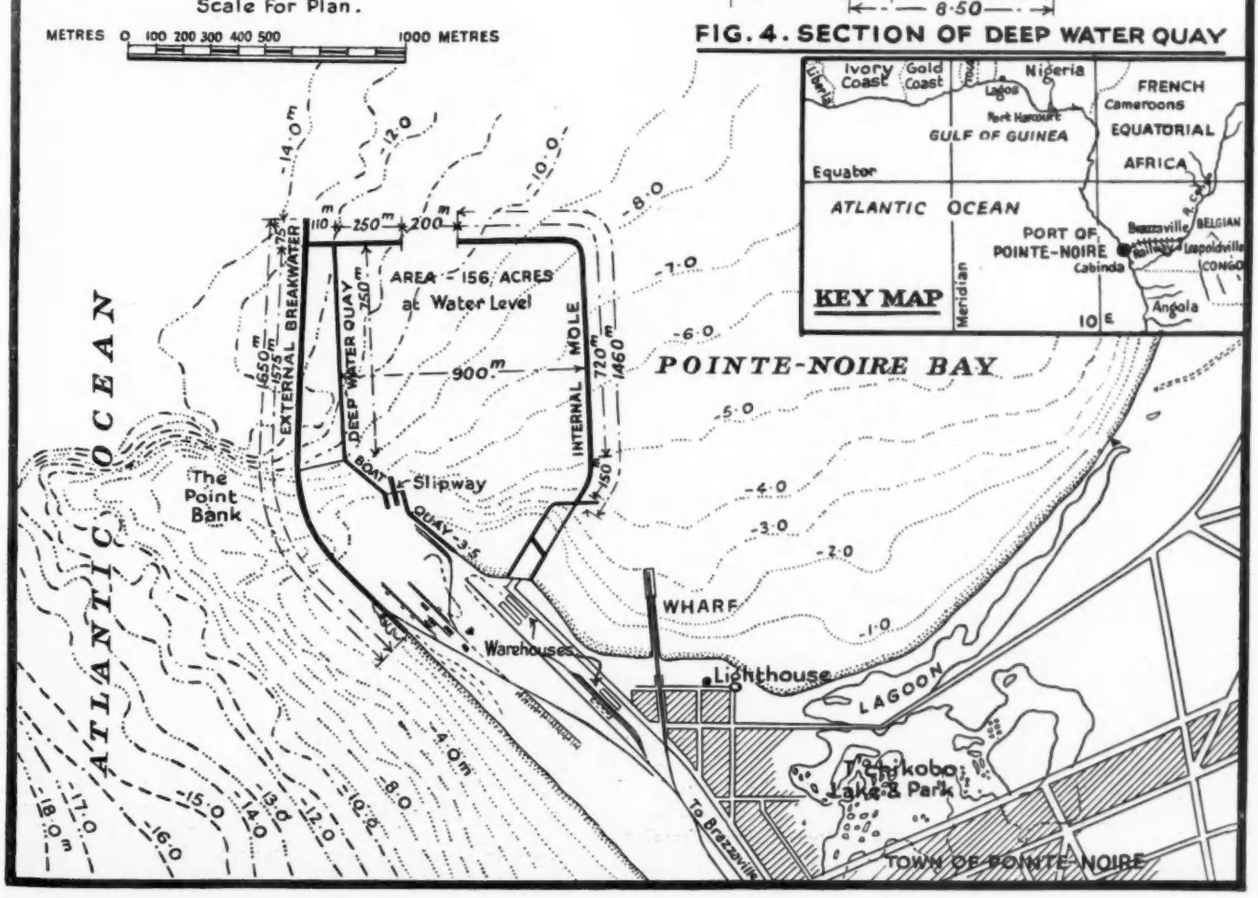


FIG. 4. SECTION OF DEEP WATER QUAY



The Channels of the River La Plata

*A Consideration of the present Navigable Channels of the River La Plata with Reference to the General System of Importation and Exportation throughout the Republic of Argentina, and of the Problems relating to their Deepening and Maintenance**

By ERNESTO BALDASSARI.
Director-General of Navigation and Ports, Republic of Argentina.

ABOUT the beginning of the year 1937, there came into my hands an important publication on the maritime ports of France, and among the articles which it contains is one by the Director of Ways of Communication and Maritime Ports in the Ministry of Public Works, the Engineer, M. P. H. Watier, which exhibits ideas of so realistic a character as regards an appreciation of natural harbours, that I have believed it opportune to allude to some of his observations in order to make clear that port problems do not always remain solved with the satisfactory lay-out of the works, because the natural evolution of progress in the general order of affairs compels, at fixed intervals, the assignment of new characteristics, which are not always compatible with the original plan and which it is only possible to adopt by means of measures, which may well be termed heroic, not only on account of the outlay involved in their execution, but because of the permanent expense occasioned by their maintenance and above all, even in spite of this, because of the necessity of taking them in order to meet the general interests of the country.

The Engineer Watier says that when he attended school in the little village of Haute Marne, his master had put in his hands a geography text-book, which enshrined a phrase which had forcibly gripped his imagination. It was more or less the following: " No nation has been so well endowed with natural harbours as France."

He declared that he felt it a matter of pride to belong to a country so favoured by nature, without suspecting that the day would come when, by reason of his office, he would have to admit, that, with the exception of some few harbours such as Vendres and some similar to the old harbour of Marseilles, the greater part of its maritime installations, especially Dunkirk, Le Havre, Caen, La Pallice, St. Louis-du-Rhone, etc., have been created under very unfavourable geographical conditions, with the result that the construction and maintenance of French harbours have involved the solution of difficult technical problems and great expenditure, into which has entered conspicuously the increments due to naval architecture in raising the tonnage of vessels to a very important extent.

In order to give some idea of this, he said it was sufficient to mention that the increase in the dimensions of ships and the unfavourable geographical conditions of the greater number of French ports, as well as the need for increasing their utility, had necessitated an expenditure of 4,149,000,000 francs, of which 2,697,000,000 francs represented the cost of dredging to greater depths, the construction of protection works and the improvement of channels leading towards the interior of the country.

General Considerations

A similar situation can be claimed for the greater part of our own ports, and especially for the port of Buenos Aires, of which the lay-out, designed when navigation sought only harbours of refuge for craft of shallow draught, such as were in existence in the 16th Century, became later a tax on maintenance for the political economy of the country, since, while the natural state of the River La Plata sufficed for the navigation conditions of that epoch, it subsequently lost this characteristic, by reason of the development of naval architecture towards large units of great tonnage and length, obliging it in order to satisfy their requirements, to plan artificial channels in the river bed, dimensioned so as to conform to its better utilisation as a waterway; in accordance therewith were formed the North, South, Martin Garcia and Punta Indio Channels.

It is to be pointed out, moreover, that, by satisfying the needs of coastal navigation, there has been maintained the principle of the execution of the Mitre Coastal Canal, a work which by reason of its importance is suitable for a special address; in the present circumstances I will deal exclusively with the existing channels on the basis of the international commerce which takes place through them.

Because, then, the port of Buenos Aires, by its location on the River La Plata comes into the category of those ports the deficient geographical conditions of which necessitate constant attention to the route which links them with the ocean, I will confine myself to this aspect of the matter, while endeavouring to keep to the standards fixed by statute which imply the safety of the largest vessels possessed by actual lines of navigation which could put into port.

Channels of the River La Plata

Planning, Shoaling and Conservation

The great depths of the River La Plata happen to be in the area called the Outer Harbour, where the depth reaches 35-ft. at zero of the Riachuelo. With it are connected the port of Buenos Aires by the North and South channels of 37 and 7,900 kms. respectively; the port of La Plata by its approach channel of 7,742 kms. and the influent system, that is, the Rivers Parana and Uruguay, by the channels of Martin Garcia (57 kms.) constituted by the Farallon Channel, the Sen Pedro Channel, San Juan Deeps and New Channel, apart from the Buenos Aires Channel, which is used exclusively for the coasting trade. All these channels are linked to the ocean by naturally existing depths in the zone of the Chico Bank and the channel of the Punta Indio (85 kms.).

The routes of the River La Plata, which I have indicated, constitute a net of 280 kms. This length, of which 201 kms. is maintained by dredging, gives the average total of accumulation per annum per km. of channel is 172,864 cu. m. (years 1924-30) in the North Channel and 215,640 cu. m. (years 1933-34) in the South Channel. By comparing these quantities with the lengths of each of them, it is found that the North Channel shoals annually to the extent of 1.73 m. (5-ft. 8-in.) and the South Channel to the extent of 2.16 m. (7-ft. 1-in.); these values have been computed on the assumption of a uniform distribution of material; as a matter of fact, there are some lengths with greater sedimentation which require continuous dredging, because they are the limiting standards for admissible draughts.

The circumstances as shown require a mean dredging performance annually of 18,000,000 cu. m. which in the year 1938 reached 21,356,880 cu. m., distributed as follows:—

North Channel	8,571,404	cu. m.
South Channel	1,143,106	,, ,,
Punta Indio Channel	8,773,404	,, ,,
Martin Garcia Channel	2,868,966	,, ,,
	21,356,880	,, ,,

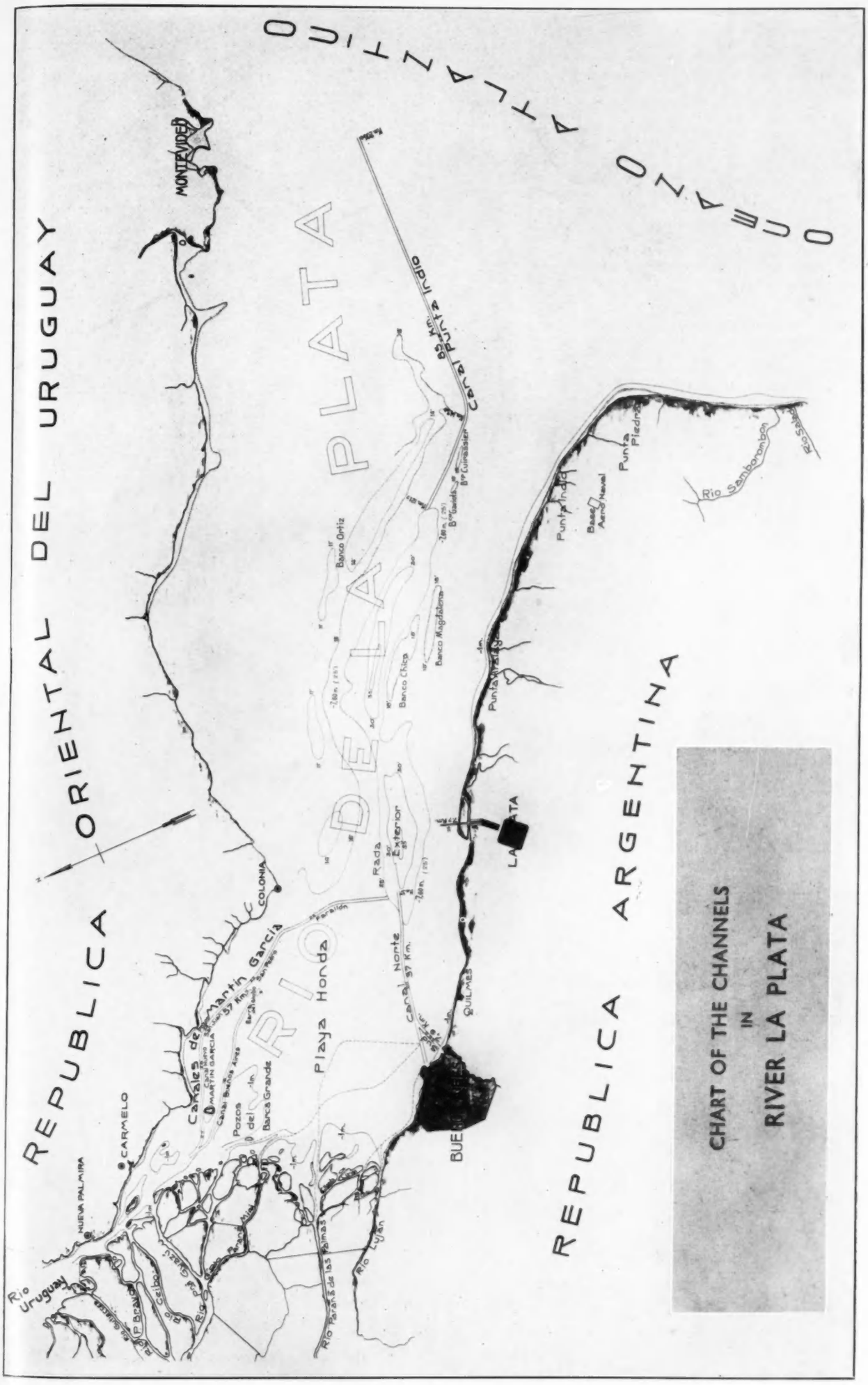
The work was carried out by utilising part of the important floating plant belonging to the Direction General of Navigation and Ports of the National Ministry of Public Works, assigning to this object 8 dredgers (4 suction and 4 bucket) and the necessary auxiliary craft. That is to say, in order to maintain these channels in normal condition for navigation, it is necessary to remove daily 60,000 cu. m.

The arrangement of these channels for the Port of Buenos Aires was the subject of full technical discussion, especially by the Engineer, D. Luis A. Huergo, who pointed out the inconvenience of forming these access channels, but as the public authorities of the period resolved on the construction of the accommodation which constituted the present Port of Madero, this meant the carrying through of the North and South Channels.

In the same way, the fixation of the Punta Indio Channel gave rise to prolonged studies by a special commission to that end, which had to consider the important part played by this stretch of navigation of the River La Plata, not only as a link between the ocean and the Port of Buenos Aires, but also as regards its effect on the Rivers Parana and Uruguay, arriving at hydraulic conditions convenient for the present channel, which has become consecrated by usage.

In view of the fact that, through this channel moves the greater part of the trade of the Republic, a serious pre-occupation exists that its development should result in the desired efficiency, since whatever inconvenience may result, once it is completed, will have repercussions affecting the whole commerce of the country. Notwithstanding this, I should point out that while the requirements of navigation are met by depths of 24 or 25-ft., there is no particular problem about the maintenance of the Punta Indio Channel; but the constant increase of ship's draught, as also the lengths of ships which visit the Plate, made it indispensable to deepen the section between kilometres 121 and 143, which are

*Paper read before the Rotary Club of Buenos Aires. Translated from the Spanish.


REPUBLICA ORIENTAL DEL URUGUAY
OCEANO ATLANTICO
RIO DE LA PLATA
REPUBLICA ARGENTINA
MONTEVIDEO
COLONIA
CARMELO
NUEVA PALMIRA
Canales de Martin Garcia
Playa Honda
Canal Norte 57 Km.
Rada Exterior
Banco Ortiz
Banco Chica
Banco Magdalena
Canal Punta Indio
Punta Indio
Punta Piedras
Base Aero Naval
Rio Samborombon
LA PLATA
QUILMES
Rio Uruguay
Rio Paraná de las Palmas
Rio Lujan
CHART OF THE CHANNELS IN RIVER LA PLATA

Channels of the River La Plata—continued

precisely the determining locations. The clay bottom is of exceptional hardness and compactness between kilometres 128 and 140, making its extraction difficult

It was following a series of experiments in reference to modifications in the cutter of suction hopper dredgers that a scheme was rendered practicable by which there were removed during the years 1931 and 1935, 2,183,943 cu. m. of hard material and 1,038,600 cu. m. of clay, and it is to be noted that this dredging, in spite of the difficult nature of the material, was carried out in the open river.

At the beginning of these operations the greatest depth in the channel was 24-ft. below zero for 100 metres width and 26-ft. 9-in. in the remainder. Since the execution of the dredging, the maximum depth has reached 28-ft. for a width of 100 metres and 29-ft. 6-in. in the rest of the channel, figures which are really satisfactory, above all if there is taken into account the favourable margin of 2-ft. provided daily by the tides.

As can be appreciated, the Punta Indio Channel did and continues to satisfy amply the requirements of the largest vessels which visit the River La Plata. It must be added that the works have been supplemented by adequate light signals so that its width amply permits of the manœuvring of the largest vessels arriving or departing. The maintenance of this channel represents 50 per cent. of the dredging done in the River La Plata.

The connection with the tributary system by means of the Martin Garcia Channels was another of the problems requiring much consideration in order to bring it into conformity with the conditions imposed by the governing passes of the River Paraguay, so as to preserve agreement with Law 4170, which prescribes dredging to 21-ft. (6.40 m.) from the mouth of the Guazn as far as the Port of Rosario; 19-ft. (5.79 m.) from this point to the Parana; 10-ft. (3.05 m.) to Corrientes by the River Parana and 19-ft. (5.79 m.) as far as Concepcion del Uruguay by the River Uruguay.

The depth established by Laws 3657 and 3885 for these channels is 19-ft. (5.791 m.), but as this does not correspond with the normal draught of shipping which operates in these parts of the river coast, the Direction General of Navigation and Ports projected an increase to 25-ft. (7.62 m.) at zero for 100 metres of width; the works were begun in 1936 and are in fact already accomplished are being continued within the adopted programme not only as regards the work of deepening, but also that of maintenance.

This dredging of the Martin Garcia Channels presents also various problems arising out of the particular geological formations which constitute the bottom where it is planned, ranging from the extremely fine sand, difficult to settle (like that of Farallon), which required a series of experiments before obtaining a satisfactory result, to the very compact plastic clay of the new channel which frequently blocked the suction tubes, giving rise not merely to delay, but also to damage to the floating plant. But the whole was salvaged by degrees and to-day with an experienced crew which is accustomed to the job, it can be said that the dredging and maintenance of the navigable routes in the River La Plata present no difficulty in consequence of these works.

As can be appreciated, the maintenance of the channel in the River La Plata is effected by dredging. Different International Congresses of Navigation during more than forty years' consideration of the most suitable means of deepening the mouths of rivers, especially those which convey sensible amounts of sediment and discharge their waters into tideless seas, have established for such cases that if, after a series of trials, it is necessary to abandon the use of dredgers, it is advisable to extend one of the deltaic channels by means of parallel dykes as far as the outer bar, so as to ensure not only the deepening of the channel, but also the transport of deposited material as far as the zone of greatest depth.

Adopting the conclusions of the International Congress of Navigation of 1900, the greater the river basin, the more considerable its dimensions and the less its slope, to which may be added the greater the requirements of navigation, the less is applicable the method of training by means of fixed works, leaving dredging as the only practical system, and this has justified the decision adopted for the River La Plata.

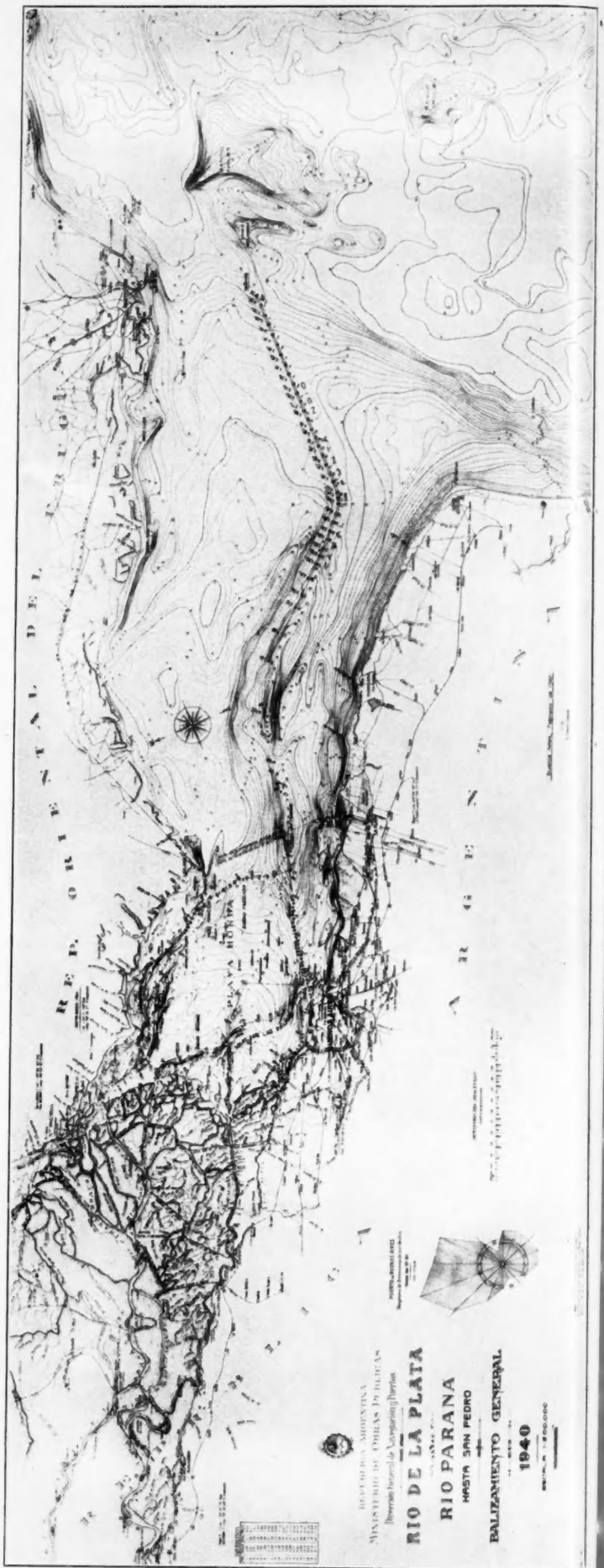
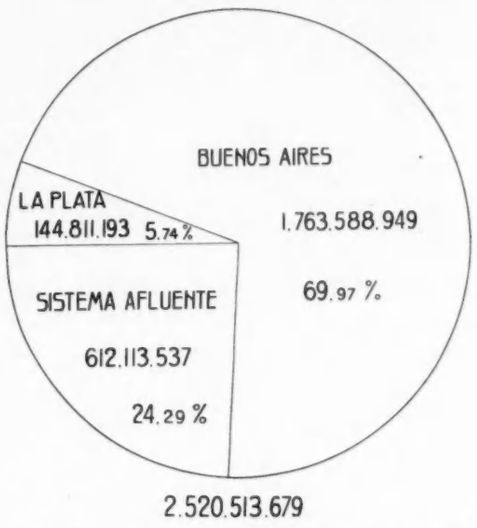


Chart of the Estuary of the River La Plata.

Channels of the River La Plata—continued

There are many countries which have had to solve similar problems, but when I reflect that they do not exceed the magnitude of our own and that all have decided for dredging and when one takes into account the great improvements effected in recent years, not only in the method of dredging, but also in the appliances and means of working which have increased proportionally their power and economy, such a system is superior to fixed works of great expense and uncertain result in which convenient location and planning play an important role.



Commercial Movement in the River La Plata in Argentine dollars. Year 1938.

Maintenance by dredging, especially in those channels planned to avoid re-filling, is compulsory, notwithstanding that there may exist alternative channels (in certain conditions, it is possible that their maintenance is beneficial) yet for the present channels, I am of opinion that the method of maintenance adopted is the most suitable.

In confirmation of this opinion, I may point out that the dredging and buoyage of the channels of the River Plate represent 1.6 per mil. of the value of the commerce which they serve. This relation can be reduced to 0.66 per mil., if allowance is made for the receipts from lighting and buoyage; such a percentage is so small with respect to the commerce benefited and even in relation to the vested interests which demanded the execution of training works, that it fully justifies the manner in which the engineers of the Ministry of Public Works have solved the problem.

Buoyage

Whoever inspects the channels of the River La Plata will appreciate the spacious and commodious way in which they have been marked, allowing the maximum safety for navigation both by day and by night. It may be indicated that of the 447 buoys placed for that purpose, 344 are luminous, 165 on the Pintsch system, 105 on the propane principle and 74 with acetylene gas.

Furthermore, daylight signal stations have recently been installed: one (luminous) in the Port of Buenos Aires, another on that of La Plata and a third on the island of Martin Garcia. These supplement the information service on tides, winds and river levels, which is sent out at intervals by the radio-telegraphic stations at the South Dock and Martin Garcia.

During the year 1938, the upkeep of this buoyage system in the extensive network of the River La Plata has represented an expenditure of $386,507.01 m/n.

General Conditions of the Route to be Conserved

Having considered exclusively the connection of the Port of Buenos Aires with the ocean, that is to say the 206 kms. forming the North Canal, Outer Roadstead, the channel in the Banco Chico zone and that of Punta Indio, I should point out that when the construction of the port was undertaken in accordance with Law No. 1257, which fixed a depth of 21-ft. in the channel, it was only required to maintain in an artificial form 15 per cent. of the length (including the South Channel), but later, the rapid change in the dimensions of ships, the draught of which continually increased, compelled frequent changes in the depths and dimensions of the channels and it was felt that, in order to correspond with draughts of 25-ft., 57 per cent. of the route should be conserved artificially, a percentage which was raised to 74 for draughts of 30-ft.

Actually, it can be stated that 80 per cent. of the network of channels in the River La Plata must be maintained artificially, that is by dredging. This fact cannot be attributed to faulty initial location of the port since it is evident that in all the cases considered to adapt it to new requirements imposed by navigation carried on in the river, nothing favoured displacement, rather the contrary; yet recognising the inconveniences which are suffered, the demands which are made, and above all the expense incurred in maintenance, I conclude categorically that at whatever cost, the Port of Buenos Aires should be preserved in the present position and in a state of respond to the importance of the navigation that operates there, since it is essential to the evolution of the country and its place on the South American Continent. Such is the policy which the rulers of different epochs have left enshrined in the successive laws, which, by degrees, changed its characteristics, enlarging and endowing the accommodation required to satisfy the important commercial needs which are in evidence.

Utilisation of the Channels

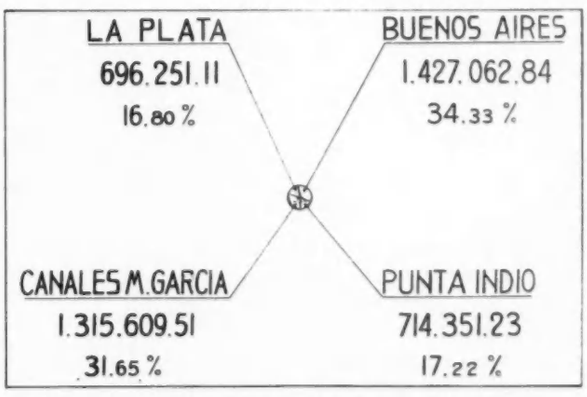
The conservation of the North Channel is standardised at 30-ft. on the Riachuelo zero for 100 metres of width and between 25 and 26-ft. in the South Channel; the Martin Garcia Channel is dredged to 25-ft. and the Punta Indio Channels to 30-ft., that is to say, the Port of Buenos Aires is connected with the open sea by a route which permits of navigation with 30-ft. of water on the Riachuelo gauge, since the favourable margin provided by the tides must also be taken into account.

In order to give an idea of the extent to which overseas and coasting vessels make use of the available depth along this route, I have analysed the effective draught of the navigation which it serves and have established that 95 per cent. use it up to 26-ft. draught, and that there are only 5 per cent. in excess of this, that is 250 craft, this being the small percentage for which it is obligatory to maintain the greater depth, because as I have explained in the course of this exposition, it is essential that the channel should be capable of receiving the largest vessels that can make convenient approach to the port accommodation.

The tonnage which is transported through the river La Plata is as follows:—For the Port of Buenos Aires: entrances, 11,893,787; clearances, 3,807,878. For the Port of La Plata: entrances, 1,815,419; clearances, 1,242,719. For the tributary system (Martin Garcia Channels): entrances, 3,876,013; clearances 6,319,055, making a total for the Punta Indio Channel of 17,585,219 tons entrances and 11,419,952 tons departures.

In order to appreciate the true magnitude of this great commercial movement that manifests itself in the channels of the River La Plata and in order to make an exact comparison with the similar movement at all the ports of the country I have felt it desirable to give the relative values of these tonnages which are shown in the following table:—

	Imports. m $ n	Exports. m $ n
Port of Buenos Aires	1,207,286,804	556,302,145
Influent System (Martin Garcia Channels)		
Port of La Plata	9,047,075	135,764,118
	1,381,856,406	1,138,657,273



Expenditure on Conservancy and Buoyage in the Channels of the River La Plata. Year 1938.

This signifies that for the Punta Indio Channel there is in existence a two-way commercial movement of which the total value is 2,520,513,679 m $ n. At the present time, if we take account that the imports and exports of all the ports of the country during 1938 (to which year the above figures refer), have been $2,725,733,719, it can be seen that 92.47 per cent. of this commerce refers to the River La Plata and only 7.53 per cent. to the ports on the maritime littoral.

In order to maintain in condition the channels of the River La Plata, as also its buoyage during the year 1938, it has been necessary to expend $4,153,278.69 m/n and the receipts in respect of lighthouses and buoys have been $2,490,285.92 m/n, that is to say that the net outlay has been $1,662,988.77 m/n, which, as

Channels of the River La Plata—continued

I have pointed out, represents only 0.66 per mil. relatively to the value of the maritime movement in the channels, completely justifying the attention always given thereto by the public authorities.

I may say that the importance of the maritime traffic manifests itself unceasingly by increasing the intensification of exploitation of the most important suitable regions in the littoral in the centre and the North and even in the Andes provinces. The greater, therefore, is the flow of products to the river ports and also to Buenos Aires, that is to say, it brings an exceptional importance to the commerce of the River La Plata.

I must not conclude without giving prominence to the views enunciated by National Senator General Bartolomé Mitre in the Senate Chamber in discussing the law for the construction of the Port of Buenos Aires in September, 1869, because he showed a broad statesmanlike vision in weighing with exactitude, that might even be termed mathematical, the importance that the future would confer on Buenos Aires and its port, not only in the country, but throughout the South American continent.

Senator Mitre said: " In treating of the Port of Buenos Aires, which is the point under discussion, I must take note of the fact that Buenos Aires is one of the last ports in the world on account of its natural disadvantages, but notwithstanding this impediment, it is the first emporium of the Argentine Republic, the first market of the Plate, and one of the first commercial locations in South America. In spite of its disadvantages and by reason of its importance, this locality is destined to expand continuously and to exist for centuries like the great commercial cities of the world. It is a mistake to subordinate its growing development to the scale and standard of particular interests.

" Such is, Mr. President, the law of commerce when it permeates cities and takes possession of them. When men by an error, or through necessity, fix an installation in an unsuitable and disadvantageous location, and there establish its sovereignty, they preserve and struggle until they triumph over nature making the work prevail, the offspring of the will. This law will create what raised and preserved Tyre and Alexandria on arid rocks and lifeless sands, what has made Genoa and Amalfi flourish in sterile plains, raised Venice and Amsterdam from the bottom of the sea, not like Venus of old in white foam, but from mountains of mud; what erected a Chicago and lifted it above level of the marsh which tries to submerge it, and, as I was saying, which founded Buenos Aires on the front of an open roadstead with depleted waters lashed by all the winds that blow.

" Who, in spite of these natural disadvantages, will be able to restrain the expansion of its economic life?—neither the trade currents which flow to this centre of population nor the power of credit which develops under the auspices of wealth, nor its growing progress, rapid and secure? Nothing, since the law of commerce is more powerful than nature and determines that it shall be a great centre in spite of its inferior harbour. Consequietly, we must set out from the starting point of those who committed the error of founding here a great commercial city and preserve in our task, improving intelligently the inconveniences which we content with. How? By developing the harbour."

To-day, 71 years after the expression of these sentiments, they have been amply justified, as can be appreciated from this dissertation and it is to be hoped that there will be a continuance —as there has been to date—of the support given to these commercial routes, knowing that they contribute to the prosperity of the country.

Mersey Dock Board

Chairman's Annual Statement

At a meeting of the Mersey Docks and Harbour Board on December 19th, the Chairman of the Board, Sir Richard D. Holt, made the following review of the operations during the year. Referring to the statement of accounts for the financial year ended 1st July last, he said: Although the first two months were before the outbreak of war, for practical purposes they might regard the whole period as a war period. Full provision had been made in the accounts for all normal charges, such as repairs, depreciation and sinking fund, and there was a small credit of £33,555 transferred to the unappropriated receipts account. Last year that surplus was £115,675.

The charges on ships and goods were not increased until January, when the discounts of 10 per cent. on the dock tonnage and wharf rates on ships and 5 per cent. on rates and dues on goods were withdrawn. It was very probable that in the near future some further increase would have to be made, but the increases compared very favourably with those made by the users of the docks, whether shipowners, merchants or labourers. The increase in income derived from rates and dues was entirely due to rates on goods, the tonnage coming to the port showing a substantial decrease. That was a natural result of the war, as in peace time ships discharged cargoes at several ports; for instance, Continental ports or London and Liverpool, or Liverpool and Glasgow, and likewise loaded at several ports, whereas under war conditions ships loaded and discharged at one port, and thus each ship brought to the port of discharge a bigger cargo than in peace time.

There had been rather less expenditure on new works, but the Waterloo entrance was making steady, if slow, progress. Work on the channels had been entirely discontinued, but they had kept in good navigable condition, which was an encouraging testimony to the efficiency of the work for their proper maintenance, on which so much labour and money had been spent during recent years. Throughout the year they had received the most loyal and ungrudging support from their staff, who had enabled a great deal of work of vital necessity to the nation to be carried out successfully on the dock estate. All had done so well that he would not care to select any for special praise, but in their name he thanked all and assured them that they were all proud of and grateful for the splendid help.

Notable Port Personalities

VI.—Sir Leopold H. Savile

Sir Leopold Halliday Savile, K.C.B., M.Inst.C.E., was born on August 31st, 1870, his father being the late Lieut-Col. John Walter Savile, of Ballendrick, Scotland. He was educated at Marlborough and King's College, London, and, later, served a pupilage under Sir John Wolfe Barry and Mr. H. M. Brunel, during which time he was employed on new entrance works at Tyne Dock and on a new dock at Barry.

Sir LEOPOLD H. SAVILE, K.C.B.
President of the Institution of Civil Engineers, 1940-41.

From 1896 to 1898, he was Assistant Engineer on the construction of the Southern Punjab Railway and subsequently on the Bengal North Western Railway. From 1899 to 1902 he was back again in England, acting as Resident Engineer on the lowering of the Ramsden Dock Sill at Barrow-in-Furness.

In 1902, he went to Australia to report and prepare plans for a proposed new harbour in New South Wales. Then he entered the office of Messrs. Coode, Son and Matthews as an assistant and was engaged on the preparation of plans for new harbour works at Singapore.

After a short spell of railway work, he became in 1904, Deputy Chief Engineer in charge of the construction of the Alexandra Dock and other contingent works for the Bombay Port Trust under the Chief Engineer, Mr. P. G. Messent. This lasted till 1919, when he was appointed Civil Engineer-in-Chief at the Admiralty and had charge of all dock and harbour work under Admiralty control, including the design and construction of the Naval Base at Singapore.

In 1932, he retired from Government service and joined the consulting firm of Sir Alexander Gibb and Partners with whom he has been engaged on harbour and dock works in Venezuela, Australia, Tasmania and elsewhere.

He has recently been elected President of the Institution of Civil Engineers and his Presidential Address is published in this issue.

Notes of the Month

Inverness Harbour Trust.

At a recent meeting of the Inverness Harbour Trust, Mr. John Macgruther was unanimously re-elected chairman. Members of the various committees were also re-elected.

Port of Rosario Authority.

It is announced that until October 16th, 1942, the Port of Rosario will continue to be operated under a concession to the Port of Rosario Authority, but after that date it will revert to the Argentine Government.

Southampton Harbour Board.

Congratulations have been extended to Sir Sidney Kimber, Vice-Chairman of the Southampton Harbour Board, on the completion of 30 years service as a member of the Board. Sir Sidney is chairman of the Works and Harbour Committee.

Oil-Fuel Facilities at Lourenco Marques.

Authorisation has been given for the erection of 8 oil tanks and the laying of a length of 8,000-ft. of pipe line at the Port of Lourenco Marques in Portuguese East Africa. The work, which is expected to be completed in the summer of 1941, will cost about £50,000.

Retirement of Free Port Director.

It is announced that Mr. Olaf Stendahl, Managing Director of the Free Port of Stockholm, has retired on account of illness, and has been succeeded by Mr. H. W. Malmström who has been an accountant in the service of the Free Port Company for several years.

New Dry Dock and Philadelphia.

A new dry dock capable of accommodating battleships of 60,000 tons deadweight is in course of construction at Philadelphia, where it will be used for naval construction purposes. Seven battleships, of 45,000 tons each, are already on order for the U.S. Navy, and a start is about to be made on the third of these.

New Port Equipment at Glasgow.

A variety of new equipment, costing more than £100,000, has been sanctioned for Glasgow Harbour by the Clyde Navigation Trustees. Among the items are six 8-ton electric level-luffing cranes, four 3-ton electric travelling portal level-luffing cranes and the conversion to level-luffing type of two 8-ton and eleven 4-ton existing fixed jib cranes. New electrical switchgear, distribution cables and other equipment will cost nearly £3,500, and mercury vapour rectifier plant is to be installed.

New Firefloat for Gothenburg.

A new firefloat has recently been put into service at the Port of Gothenburg. It was built in the yards of the A/B Lodase Vary and has a length of 14.35 m. and a breadth of 3.8 m. It is fitted with a Penta-Hesselman motor, giving a speed of 10 knots. The motor also drives a fire pump, which has a capacity of 4,600 litres of water per minute. There are six hydrants and and a monitor and two pipes for delivering foam. The vessel has a draught of 1.5 m. and is designed for use in shallow channels, but is sufficiently strong to withstand moderate ice pressure.

Clyde Navigation Trust Appointments.

In connection with a revision of the staffing arrangements of the Clyde Navigation Trust, Mr. Robert Millar, treasurer, has been appointed as assistant general manager and Mr. James Logan chief assistant to the general manager, as secretary. Mr. Thomas Wilson, accountant, succeeds Mr. Millar as treasurer, and Mr. George A. Macara, cashier, succeeds Mr. Wilson as accountant. The trustees have also approved the appointment of an additional assistant harbour master. The new appointments, it is stated, will cost £1,850 per annum, and simultaneous salary increases, £2,015.

Kirkcudbright Harbour Finances.

Difficulties are being experienced at the harbour of Kirkcudbright in maintaining a solvent condition. The Town Clerk has been in communication with the Scottish Home Office and, as a result of advice tendered in that quarter, also with the County Council to see if a grant in aid could be obtained. The latter body, however, are of opinion that the benefit derived by the landward area is insufficient to justify a contribution towards the maintenance of the harbour, and have informed the Town Council accordingly. Further correspondence with the Home Office has since been in progress and the grain merchants using the harbour are being asked to contribute towards the deficit in revenue.

Panama Canal Improvements.

Tenders have been received by the United States Government for the excavation required for a third set of locks on the Panama Canal and work is expected to be commenced at an early date.

Transhipment Trade of the United States.

The Port of New York Authority have issued statistics showing an increase of nearly 140 per cent. in transhipment at the Port of New York during the first half of 1940, and of 150 per cent. for the entire country.

The St. Lawrence Seaway Project.

President Roosevelt has announced his intention of asking United States Congress to approve the treaty with Canada for the completion of the St. Lawrence seaway and power project, one of the objects of which is to provide a channel for ocean-going vessels to and from the Great Lakes of North America.

New Transit Sheds at Calcutta.

The Commissioners for the Port of Calcutta have approved the construction of two new sheds at Kantapuker at a cost of roughly 4 lakhs of rupees. The sheds will be single-storey structures, each 495-ft. long by 90-ft. wide with platforms along each side and a roadway frontage.

Linking of Polish and German Waterways.

The Polish River Vistula, which has its outlet in the Baltic, is to be linked with the German system of inland waterways, according to a recent dispatch from Cracew. The Vistula is also to be made navigable for sea-going vessels as far as Warsaw and for smaller craft as far as Cracow, where additional harbour accommodation is to be provided.

Malmö Free Port Annual Report.

At the recent annual meeting of the Malmö Free Port Company, it was stated that the year's working during 1939 constituted a record for the company. The number of vessels (924 with net tonnage of 590,000) which called at the port compares with 870 vessels of 517,700 net tons, in the previous year. Goods handled totailed 210,000 tons as against 174,500 tons in 1938.

Deepening of New Zealand Harbour.

A long and troublesome process of blasting and dredging has recently been put in hand for the deepening of the harbour at New Plymouth, New Zealand. The harbour bottom consists of a very hard conglomerate, in which are embedded masses of boulders and rubble, some weighing from 10 to 20 tons each. Progress is necessarily slow and it is anticipated that the work will take some seven or eight years to complete.

Galatz as a Base for Submarines.

It is surmised that Germany is using the Rumanian port of Galatz as a submarine base for craft small enough to navigate the canals and the River Danube, on which latter Galatz is situated, near its junction, with the Sereth and the Pruth. Prior to the war, Galatz was used as a transhipment port for the transfer of goods from river lighters to ocean steamers, mostly of British nationality. The wharves were largely constructed with British capital.

Trade of the Port of Petsamo.

German action having stopped the export to the United States of goods from Petsamo, the northernmost Finnish port, the possibility of using the trans-Siberian route is being considered in connection with the maintenance of American trade with Sweden. By an agreement recently signed between Sweden and Russia, Sweden is guaranteed the use of the Russian chief ports for its foreign trade to whatever extent transport facilities are available within the U.S.S.R. The cost of transport over the trans-Siberian railway is, however, likely to prove prohibitive, or, at any rate, uneconomical.

Navigational Aids in Columbia River.

The " Bulletin " of the United States Coast Guard states that an increase is being planned in the number of navigational aids in the Columbia River with its tributaries, in connection with the dredging of a 27-ft. channel now being undertaken by the U.S. Army Corps of Engineers. It is estimated that approximately $64,000 will be expended on the section of the river between Vancouver, Wash., and Bonneville, Oreg. Between The Dalles and the mouth of the Snake River, the new aids will cost about $29,000 and along the Snake River itself, a further $33,000 will be expended. A maintenance base, with a barge and other floating equipment will cost about $35,000.

Correspondence

To the Editor of "The Dock and Harbour Authority"

Dear Sir,—

Timber versus Reinforced Concrete for Jetties and Wharves.

I have read with much interest the Editorial Comments and the article on the subject of "Timber versus Reinforced Concrete" in the last issue of your excellent paper.

I agree with the author of the article that the trend of replacing timber by reinforced concrete in maritime constructions does not always lead to the technically best solution of the problem, but I must dispute the various figures given to prove the greater economy of the use of timber as they are very misleading.

I shall first deal with the relative costs given for various timbers and reinforced concrete as materials for piles. On the basis of pre-war prices in the London area, the approximate cost of a 12-in. sq. x 40-ft. long reinforced concrete pile would be:

Concrete 1-1½-3 :	1 cu. ft. at 28s. per cu. yd. equals	1s. 0½d.	per lin. ft.
Reinforcement :	9.5 lbs at 14s. per cwt. ,,	1s. 2½d.	,, ,,
Shuttering :	⅓ sq. yd. at 2s. per sq. yd. ,,	8d.	,, ,,
		2s. 11d.	,, ,,
Add for plant, supervision, etc., 20%		7d.	,, ,,
Cost ready for driving, excluding contractor's profit		3s. 6d.	,, ,,

The average pre-war prices for Oregon Pine (creosoted), Pitch Pine (creosoted) and Greenheart were: 3s. per cu. ft, 4s. 6d. per cu. ft., and 7s. per cu. ft. respectively.

The article gave the relative costs as:

Oregon Pine	Pitch Pine	Greenheart	Reinforced Concrete
3	4	6	6

whereas they more accurately were:

3	4.5	7.0	3.5

as shown above.

I am of opinion that the comparison drawn for the relative cost of a complete wharf is as fallacious as that drawn for the relative unit material prices.

I shall, however, not go into this in detail but instead give a few figures for a wharf constructed in the Thames shortly before the outbreak of the war.

The wharf runs parallel to the river bank with three approaches to same; the total deck area, including approaches, is 28,000 sq. ft. The pile lengths vary from 40-ft. in the approaches to 56-ft. in the wharf front. The wharf carries a crane track.

Alternative tenders were submitted from which the following prices per sq. ft. of deck area were calculated:—

1.	Timber construction throughout using creosoted Oregon Pine	20s. per sq. ft.
2.	Timber construction mainly but crane track in reinforced concrete	17s. ,, ,,
3.	Reinforced concrete structure with timber fender piles	15s. ,, ,,

From this it would appear that the relative cost of a reinforced concrete wharf or jetty to that of a similar timber structure immediately before the war was 4 to 5 instead of 9 to 4 as stated in the article.

It would further appear that when concentrated loads, such as a crane track, have to be supported, reinforced concrete has a very distinctive advantage over timber.

In regard to the life of reinforced concrete in maritime work, the application is hardly old enough for us to form any opinion, and there is no doubt that the improved methods of making concrete, together with the greater knowledge of the conditions favourable for obtaining a dense concrete have greatly increased the life of a structure built to-day, as compared with one built 25 years ago.

In this connection I may mention that the firm I am working for have built several reinforced concrete jetties, piers and wharves more than 30 years ago, and they are all still giving excellent service and only very few repairs have been required.

The article refers to reinforced concrete structures in American waters showing serious deterioration after a short span of years. I have, some 15 years ago, had the opportunity to see some American specifications and designs for jetties. The concrete for the piles was proportioned 1-2-4 and placing by chutes was then in general use with the consequent sloppy consistency. Further there was only one inch cover to the principal reinforcement bars. If the structures referred to have been of a similar design it is not surprising that they should deteriorate quickly, but this can hardly be blamed to reinforced concrete as a material.

I have no knowledge of the Auckland disaster, but should be thankful for a reference to where some information on this could be found* I do, however, remember having myself seen in Auckland Harbour the heads of reinforced concrete piles being removed to the required level by the help of a charge of dynamite. Probably this procedure can have had something to do with a later failure of the pile under loading.

*See Editorial Comment in this issue.—[Editor].

It should also be borne in mind when choosing between reinforced concrete and timber that the former is a national product, whereas the latter has to be imported, and this is a factor of considerable importance as well in peace-time as in war-time.

Yours faithfully,

P. G. HANSEN,
Assistant Manager,
Christiani & Nielsen, Ltd.

54, Victoria Street,
Westminster, S.W.1.
12th November, 1940.

The following are the comments made by our Contributor in reply to Mr. Hansen's criticisms on his article:—

In the first place as to the relative costs, the discrepancy in the figures quoted appears to be due to a misunderstanding. In the contributed article, the term "pre-war" referred to the 1914-1918 war, whilst the critic's "pre-war" prices were those of 1938 or early 1939. The advantage of adopting the earlier period for comparative purposes is that, prior to 1914, prices were stabilised and varied within small and well-defined limits, whereas after, say, 1915, prices soared.

The figures given as to relative costs, viz.:—

Oregon Pine	Pitch Pine	Greenheart	Reinforced Concrete
3	4	6	6

were, of course, only approximate figures, but were not mere guesses; they were based on actual costs incurred at the time.

It is, of course, true that the cost of fabricating reinforced concrete piles has been considerably reduced since the date the above comparison was made, and the firm is to be congratulated on being able to produce reinforced concrete piles 40-ft. long by 12-in. by 12-in. at 3s. 6d. per lineal foot, which is about half the cost in 1914. The comparison made, however, is invalidated by the fact that the 3s. 6d. per cubic foot mentioned does not include producer's profit, whilst the prices mentioned for timber do include this item. It would be interesting to know what the price to the purchaser would be, and this is the figure which should be compared with the figures mentioned for Oregon and Pitch Pine.

It may be of interest to point out that a quay extension was actually carried out in the year 1932 with Empire timber costing 1s. 6d. per cubic foot delivered on the site of the work, and it is difficult to understand why the cost of timber in London should be so much higher. In any case it is difficult to make comparisons of costs of real value at different times and places, with prices fluctuating so rapidly, but when it is considered that round timber piles, 40-ft. long, have actually been driven at a cost for the material of 10½d. per lineal foot and others in imported square timber at a price as low as 1s. 6d. and seldom higher than 1s. 9d. per cubic foot, it will be understood how impossible it is in normal times for concrete piles to compete with timber. How much more so when strength in bending is taken into account.

The piles referred to, which were procured at 10½d. per lineal foot, were of local Larch—an excellent timber for the purpose, as experience has shown that it has a longer life in sea water than either Douglas Fir or Pitch Pine.

These piles can be bought to-day at 1s. to 2s. per lineal foot, according to length, the maximum being about 50-ft. On the other hand it must be admitted that, so far as present prices are concerned, it would be cheaper to build a jetty in reinforced concrete than in imported Empire timber, such as Douglas Fir or Pitch Pine, with, as stated, the added advantage that the materials constituting reinforced concrete are of home manufacture and not imported.

Issue is joined at once, however, with the opinion "that the comparison drawn for the relative cost of a complete wharf is as fallacious as that drawn for the relative unit material prices." It was this very issue that was the "raison d'être" of the contribution.

The writer of the article has been struck with the extraordinary discrepancy between the prices actually paid for quays recently constructed and those of a former generation when timber was in fashion. The loss to the nation as a whole must by now run into millions.

In 1914 or earlier, timber quays capable of accommodating the largest ocean-going steamers were built for £30 per foot lineal, and this figure seldom varied more than a pound or two over a period of years. At that time a quay, either of "gravity wall" type or of reinforced concrete, could not be constructed at much under £100 per foot lineal.

The recent pre-war (1939) price of the same timber quay was £46 per foot lineal, whereas there have been deep-water quays built, descriptions of which have appeared in the technical journals, and the price is seldom less than £150 per foot lineal. In one case, though there was a noticeable diffidence in disclosing costs, there was enough information given to show that the cost was somewhere in the region of £250 per foot lineal.

It can be stated emphatically that, in the past, timber quays have actually been constructed at much less cost than reinforced concrete quays or than "gravity walls' of similar capacity and generally at less than half the price.

Correspondence—continued

To the Editor of "The Dock and Harbour Authority"

Dear Sir,—

In "Editorial Comments" of your November issue, you state under the heading of "Timber versus Reinforced Concrete," that the contributor of the article "Relative Values of Reinforced Concrete and Timber in Jetty and Wharf Construction," discusses *quite fairly* the advantages and disadvantages of these two materials.

I should like to object to your use of the words "quite fairly" as the article is obviously written by one strongly prejudiced against the use of reinforced concrete in jetties.

Your contributor's arguments regarding comparative strengths, are based in the main, on the assumption that the strength of a piled jetty depends on its resistance to bending stresses set up in the piles due to applied horizontal forces. This is only so if the design does not include raking piles. With a good design, incorporating raking piles and a strong deck, almost the whole of the applied horizontal forces can be taken in direct tension and compression on the piles. Bending stresses in the piles are secondary only, and are very small compared with the direct stresses. It is easy to make a design in reinforced concrete incorporating raking piles, as the connections between the reinforced concrete piles and reinforced concrete deck are simple, and the full forces can be transmitted through these connections. Not so with timber piles. Connections here are difficult, unreliable and costly to make if the forces to be transmitted are large.

Another point your contributor overlooks in discussing relative strengths, is that a properly designed reinforced concrete deck has great stiffness as a horizontal girder, and will spread a horizontal point load over many bents; in other words the reinforced concrete jetty will act as a whole in resisting horizontal forces. A horizontal point load is spread very little by a timber deck and has therefore to be taken on a few bents only.

It can easily be shown that a well designed jetty in reinforced concrete with a strong deck and a proper combination of vertical and raking piles, is many times stronger in resisting an applied horizontal force than is a jetty in timber with braced vertical piles only, using the same total volume of piles and bracings.

Unfortunately, many designs of reinforced concrete jetties have been copies of timber jetties, little advantage having been taken of the different properties of the newer material. Jetties constructed thus are worthy of many of your contributor's criticisms.

In comparing the relative merits of reinforced concrete and timber for the construction of jetties, it should be realised that much can be said for and against either, and in considering which material should be adopted for any particular jetty, the following points should be examined:—

1.—Are Teredos or similar pests present to a harmful extent? If they are, then the jetty should be constructed in reinforced concrete. If they are not, then so far as this point is concerned, either form of construction will be suitable.

2.—Length of piles. If the length is greater than 50 to 55-ft. then reinforced concrete piles will probably be chosen as it is always difficult and costly to obtain timber piles longer than 55-ft. and scarfing is not advisable. Reinforced concrete piles can be cast and driven up to 100-ft. in length. If the length is less than 50-ft. then so far as this point is concerned, either form of construction is suitable.

3.—If no decision has been arrived at after considering points 1 and 2, then comparative estimates should be made. In this connection I should like to emphasise that the design of the reinforced concrete jetty should be one that takes advantage of the properties of this material, and not just be a timber jetty constructed in reinforced concrete, as so often is the case.

I should like to add that it is a little unfortunate that your contributor's article should appear just now, when it is practically impossible to obtain timber of scantlings suitable for the construction of jetties.

Yours faithfully,

100, Farley Road,
Selsdon, Surrey.

E. M. BARNES.
27th November, 1940.

To the Editor of "The Dock and Harbour Authority"

Dear Sir,—

Location of Echo Soundings.

Several papers have recently been published in *The Dock and Harbour Authority* dealing with quick methods of plotting fixes whilst afloat. A very ingenious method of fixation by sextantgraph plotting is outlined in the June, 1939, issue. All methods, however, depend upon the existence of suitable prominent points from which sextant angles can be obtained.

Two years ago the writer had occasion to carry out a reconnaissance survey of portion of the northern approach to the harbour at Fremantle, Western Australia. The coast line north of Fremantle is devoid of any prominent marks suitable for reading sextant angles, and the excellent marks that existed south of Fremantle were not suitably placed to give accurate fixes with the station pointer.

The echo sounder used was mounted on the steam tug "Ivanhoe," a vessel 70-ft. long by 17-ft. beam and drawing 8-ft. 6-in. The sound emitters were mounted amidships abreast of the funnel. The cruising speed of the "Ivanhoe" was in the vicinity of 8 knots.

As time was limited it was decided to make full use of the speed of the boat. This meant that the usual methods of location at sea by sextant angles became difficult, owing to the speed, and impossible, owing to the absence of land marks. It was decided therefore to fix the course of the ship by means of theodolite angles taken from two points on shore.

Two stations were established 7 miles apart on selected high ground. Angles on the funnel of the "Ivanhoe" were read every two minutes by theodolite. On board the "Ivanhoe" the echo-sounding graph was marked every two minutes. Great care was taken to see that all readings were taken simultaneously and to do this three chronometers were synchronized, and each morning their error from the standard noted. The use of these chronometers ensured that readings were taken with an error of less than half-a-second, and proved superior to a previous system used of taking readings at a signal from the boat. The distance of the boat from the theodolite stations varied up to a maximum of 10 miles.

The accuracy of the survey was therefore practically equal to that obtainable on land. Care was taken to keep the "Ivanhoe" travelling as nearly as possible at a constant speed. The distance between fixes was approximately 1,600-ft. and intermediate points were interpolated.

The accuracy of the echo sounder was checked both at the beginning and the end of the day's work by traversing the entrance channel to the harbour, which is dredged to a uniform depth. A further check was obtained in the office by checking all points where the course of the "Ivanhoe" intersected.

The procedure in the office was to plot each day's work separately on tracing paper. These were then transferred to a master tracing. Each day's work was made to overlap that previously carried out, and this gave yet another check on the work.

Location of the course of the boat was complicated by a remarkable and irregular magnetic variation in the compass over the area being surveyed. Where possible sextant angles were used, but, in general, reliance was placed on the speed of the boat remaining constant. For instance, from a known point the "Ivanhoe" would steam due north and at intervals of two minutes, canister buoys would be dropped overboard. On reaching the point furthest north, she would then steam, say, 20 minutes due west, two minutes due south, then due east when she should pass the base line at the last buoy but one, and so on, zig-zagging back to the starting point.

This rough and ready method did not affect the accuracy of the finished work, because at all times the actual position of the "Ivanhoe" was accurately known from the theodolite angles taken from the shore stations.

By the above means a reconnaissance survey covering an area of 30 square miles was carried out in 10 days.

Yours faithfully,

Fremantle Harbour Trust,
Western Australia.

ALLAN BENNETT.
1st February, 1940.

South African Harbours

From a bulletin recently issued by the South African Railways and Harbour Administration, covering the period up to the end of August last, it is to be gathered that steady progress is being made at the various port developments schemes at present in hand.

At Capetown, work is proceeding satisfactorily on the provision of additional quayage to form "E," "F," "G" and "H" berths. The foundation for the new quay wall has been laid for a length of 2,530-ft., while blockwork construction has been completed to the extent of 2,450 lineal ft. The total quantity of material dredged on the site and deposited in the reclamation area now amounts to 8½ million cu. yds. or 76 per cent. of the whole, this being the result of rather more than two years' work, operations having been commenced in May, 1938. Over 31,000 blocks have been removed from the old random rubble mole and this demolition work is approaching completion. Further substantial progress has been made in the construction of the new Eastern Mole, the sand filling for which is completed and the mooring bollards installed. Six hundred yards of rail track have been laid along the quay.

At Port Elizabeth, the reclamation of a large area of foreshore for the extension of the railway service and other purposes has proceeded satisfactorily, and 4,235-ft. of blockwork has been laid.

At East London, where a new turning basin and mail boat quay, with sheds and appurtenances, are in hand, good progress has been made, and work is proceeding on the extension of the existing slipway, the piles for which have been driven.

At Durban, the first two additional deep-water berths, with their quays, sheds, capstans and cranes, have been completed and put into commission. Twenty-three caissons have been placed in position at the "T" Jetty, and a large quantity of rubble and spoil deposited behind the caissons at the West wall. The superstructural work on the caissons is well advanced as also the dredging and reclamation operations involved in the construction of the jetty.

Ancient Harbours*

Being the Presidential Address of Sir Leopold Halliday Savile, K.C.B., to the Institution of Civil Engineers, November, 1940

IT is perhaps a good thing during times of great stress occasionally to relax and to turn our thoughts right away from the present struggle. Therefore, when considering a suitable subject for my address, I decided to follow the example set by Mr. W. J. E. Binnie in his Presidential address two years ago and, leaving modern times, to touch upon ancient history. Since harbour engineering has been the branch of our profession with which I have been principally associated for most of my career, I propose to deal with harbours, from the dawn of written history to the early days of the Roman Empire.

The Four Harbours of Alexandria

Shipbuilding and harbour engineering are two of the oldest branches of our profession. It is well established that before 3300 B.C. the Egyptians built sea-going ships and that they made voyages to far lands to procure iron, lead, silver, and other materials; and it is recorded on the Palermo stone that about 3000 B.C King Seneferu built sixty great ships to go to the Syrian coast to bring cedarwood for his works. In the British Museum is a stone statue of Bedja, son of Ankhu, one of the great shipbuilders of his days. The terminus of these voyages was on the Canopic branch of the Nile, where was situated A-ur or the Great Door, which Mr. P. E. Newberry calls "an ancient Alexandria of a period earlier than 3000 B.C." Little is known about this harbour, except that Narmer, one of the earliest kings of the First Dynasty, considered it of great importance and decided to conquer the petty kingdom of Harpoon, to which it belonged. It was an inland port and probably had the disadvantages of that type, especially as it lay on the banks of an arm of the delta. The actual site of the port is not known, but I refer to it because it is the earliest harbour of which I have found mention and because it marks the beginning of the harbour of Alexandria, which, I think, has the longest history of any harbour in the world. I propose to devote some of my time to a study of the great schemes adopted on the Alexandrian site over a period of nearly 5,000 years (fig. 1). There have been four distinct harbour building periods—the harbour of A-ur, about 3000 B.C.; the great harbour of Pharos, soon after 2000 B.C.; the harbour of Alexander the Great, begun in 332 B.C.; and the modern harbour, which dates from 1870 A.D.

The Great Harbour of Pharos

The Great Harbour of Pharos (fig. 2) was typical of the pre-hellenic form of massive structure, far more massive than some of the great harbours of modern times, and it is well worth study. Its layout and the skilful use made of the configuration of the bed of the sea might have been

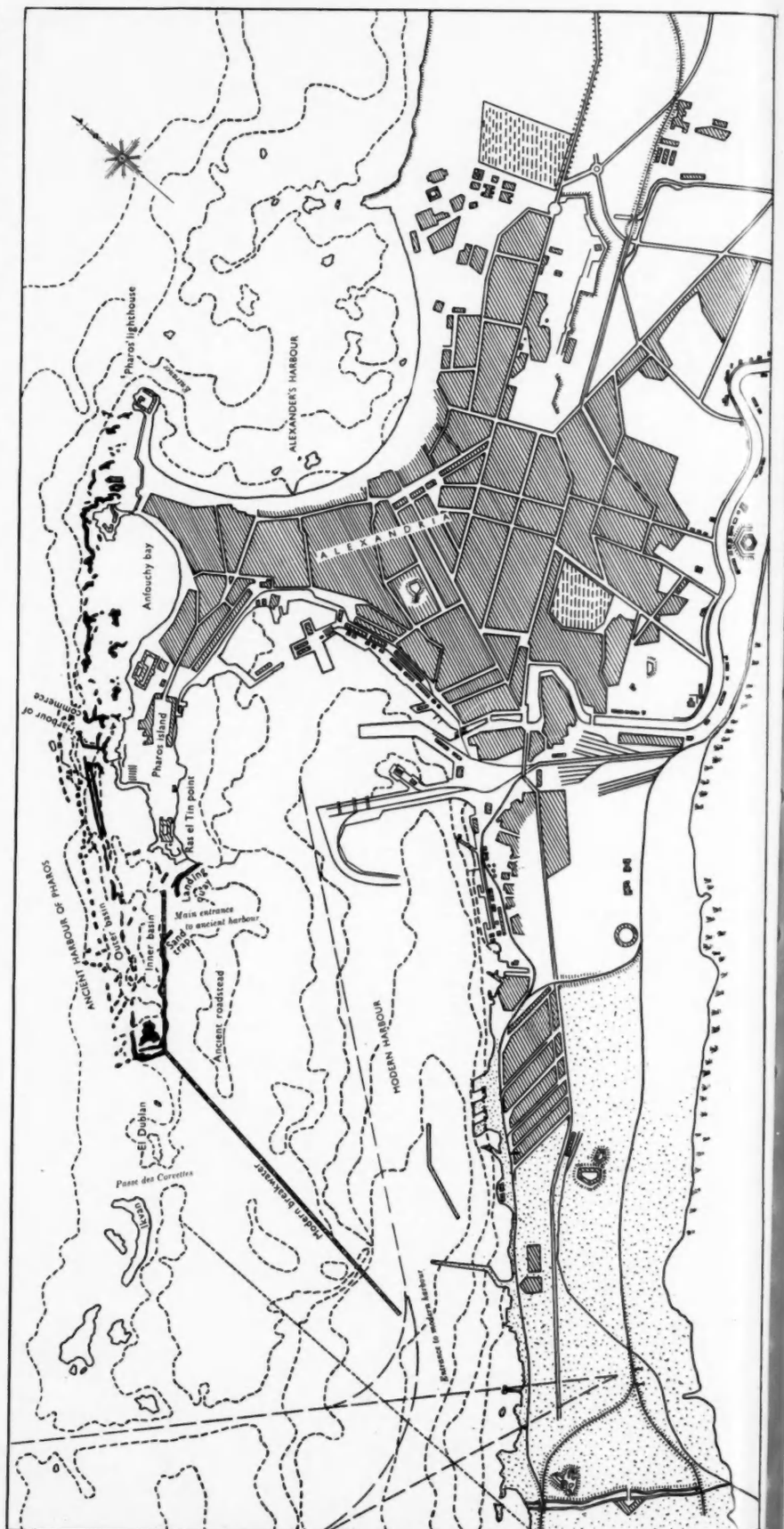


Fig. 1. Alexandria, showing the Ancient Harbour of Pharos, Alexander's Harbour, and the Modern Harbour.

*Extracted by permission from the Journal of the Institution of Civil Engineers.

Ancient Harbours – continued

the work of a modern harbour engineer. When, says M. Gaston Jondet, " one examines the largeness of the project and ponders on the boldness of its execution, it becomes obvious that it was conceived by a sovereign power of unequalled breadth of view, a realistic genius capable of conquering and keeping the mastery of the Mediterranean Sea." Who the realistic genius was we do not know, for Egyptian history, curiously enough, has no record of this harbour. M. Raymond Weill attributes both its conception and its construction to the Minoan Cretans, who at that time were the greatest sea-faring power in the Mediterranean. It could not, however, have been made without the co-operation of the reigning Pharoah, possibly Senusret of the Twelfth Dynasty, a famous builder of colossal buildings typical of the Egyptian, Minoan, and Mycenæan civilisations of those early times. This gives us a date somewhere between 2000 and 1800 B.C.

The harbour was based at its eastern end upon the island of Pharos, and at its western on the rock of Abu Bakar. It also took advantage of the submerged ridge running from Marabout Point to the north of Pharos, and of the shelf which sloped from this towards the deep sea. From the Bay of Ras el Tin at the western end of Pharos to the Abu Bakar Rock there is a deep pool, bounded on its northern edge by the submerged ridge. It was by surrounding this pool with breakwaters and piers that the great inner basin was formed. Seawards of this, another series of breakwaters, using the outer edge of the shelf, enclosed the outer basin. The two basins together formed a magnificent harbour about 300 acres in extent.

The entrance to the harbour was on the south, and the approach channel crossed the submerged ridge by the Passe des Corvettes between the Ikvan and El Dublan Rocks. Between these rocks, the southern boundary of the harbour, and the Island of Pharos, not then joined to the mainland of Egypt, was a sheltered roadstead for ships making the entrance against the prevailing north-west wind.

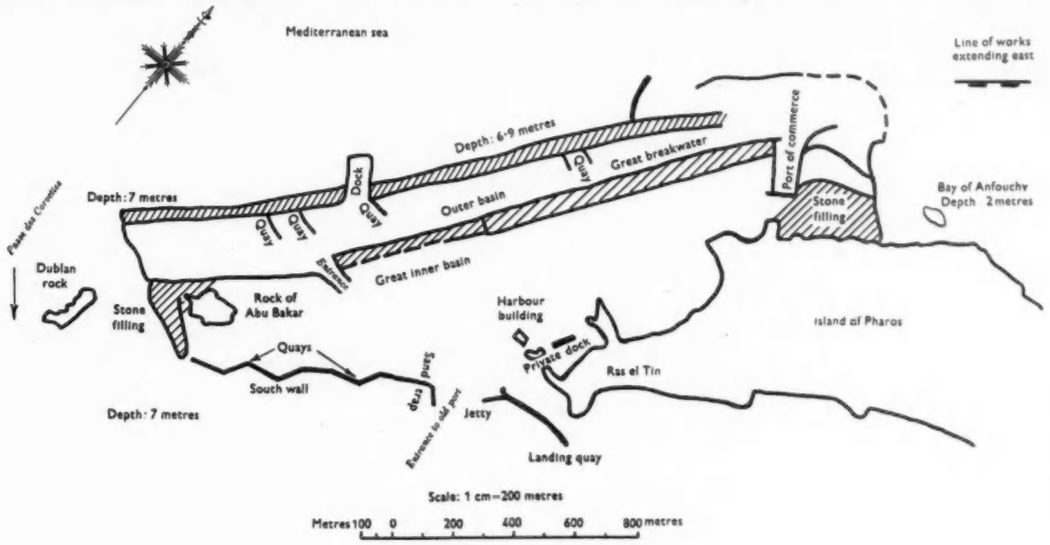
I will now try to give some idea of the construction of the works. On the right the entrance is flanked by a slightly-curved landing quay (fig. 3) running in a north-east—south-west line, founded on a firm mass of argillaceous sand in the shallow water off the end of Ras el Tin Point. This quay was 525-ft. long by 46-ft. wide and 18-20-ft. high, and was built of large rough-hewn blocks of limestone from the quarries at Mex on the mainland, carefully laid in courses and bonded with small aggregate and sand well tamped down. The top was paved with pentagonal flags 26-ft. long by 23-ft. wide, all of the same shape and forming a chequer-work. The walls were vertical, but the upper surface had a gradient of 3 per cent. No cement or mortar was used on this or on any of the quays or breakwaters.

Jutting out from the end of this quay, and partly enclosing the harbour entrance, was a jetty about 426-ft. long, consisting of two parallel walls just over 41-ft. apart, closed at the end by a cross-wall. These walls were 7½-ft. wide at the top, and were built with a slight batter on each face. The space thus enclosed was filled with rubble and sand, and had no paving on the upper surface.

The main entrance of which this quay and jetty formed the eastern protection was 650-ft. wide. The south wall of the harbour was 2,300-ft. long, in a general east and west direction, but its course was irregular because it was largely built up on a line of reefs which bordered the deep water of the inner basin. The upper parts of this wall were built of large, carefully-hewn blocks ranging from 8-ft. to 16-ft. in length, laid with great precision. Again no cement was used, but the joints were filled with small stones. At the main entrance end of the wall was a short protective mole or spur, 360-ft. long by 65-ft. wide, the object of which appears to have been to form a sand-trap to prevent the drift of sand caused by the south and south-west winds from blocking the entrance to the harbour.

The pavement of the southern wall (fig. 4) is of interest because its pattern is typical of the pavements found in Minoan Crete and lends support to the view that the harbour was the work of Cretan engineers. It was composed of large slabs of stone, many 16-ft. long, laid so that the joints radiated from a centre.

The southern wall ended at a point a short distance south-west of Abu Bakar. Thence ran two walls, each about 490-ft. long, one in a north and the other in a north-west direction, enclosing between them a triangular area of about 28,000 square yards. This space was filled in by large blocks of limestone and formed an immensely powerful breakwater, much of which is still in existence and can be seen under water on a clear day.



Pre-Hellenic Port of Pharos, 1800 B.C.

The most marvellous works of this harbour were, I think, the two great breakwaters that guarded the inner basin and the outer basin. The first, which M. Jondet called the great breakwater, started from the northern end of the triangular mass just referred to and ran for 8,500-ft. in a straight line to the western end of Anfouchy Bay. For its first 2,000-ft. it was built in the same way as the southern wall, except that the part bordering the Abu Bakar Rock seems to have been filled in with dumped stone to form a solid mass. Then followed a length of 6,500-ft. which needed to be very strongly made. Two walls founded on firm argillaceous sand overlying the submerged ridge already mentioned, were built 130-200-ft. apart (fig. 5). Each ranged in width at its upper surface from 26-ft. to 40-ft., and had a batter of 30 to 1, and each was protected by a substantial toe. Their height, judged from the remains that have been found under water, appears to have ranged from 20 to 30-ft. The depth of water in the basin is unknown, but it may be estimated at 25-40-ft., with considerably deeper patches in the pool of Ras el Tin. The walls were built of enormous blocks of stone roughly hewn and coarsely laid. All of the space between the walls was filled with large blocks, forming a surface between 180-ft. and 250-ft. wide. The great width would enable defending parties to move rapidly to any part of the harbour during piratical attacks, whilst in normal times it was useful for drying and repairing sails and fishing nets, weaving ropes, and so forth.

Running parallel to this breakwater, and about 650-ft. distant from it, was another of similar construction enclosing the outer basin, the entrance to which was by a passage through the inner breakwater a little to the north-east of Abu Bakar, between its single-wall and double-wall portion. Protection was afforded by two moles running in the same direction as the landing quay and protective mole guarding the main entrance.

The whole of the inner breakwater formed an immense quay. Besides this, several jetties about 60 metres (197-ft.) long ran out from the outer breakwater, and nearly the whole of the south wall of the inner basin formed a broad quay, giving a total length of quay about 10,000-ft. There was also a kind of dock built out seawards from the outer breakwater, the purpose of which is not clear. It may have been another entrance to the harbour.

The remains at the eastern end of the harbour bordering on Anfouchy Bay are not so easy to interpret. About 650-ft. from its end the great breakwater of the inner harbour was pierced by an opening 160-ft. wide and 525-ft. long, to form what M. Jondet calls the commercial harbour. This small port had two entrances, one from the outer basin, and one direct from the sea, carefully

Ancient Harbours—continued

protected by two incurving breakwaters. Beyond the commercial harbour the great breakwater continued for a short distance to the shallow water at the commencement of Anfouchy Bay, where a north and south cross wall closed the harbour. A very large area between the breakwater, the wall, and the shore of the island was filled in with large stone blocks, as at the west of Abu Bakar.

A few words as to the cause of its disappearance may be interesting, although "disappearance" is really a misnomer, because, as M. Jondet has shown, a very large portion of the works still exists and on a calm day parts of them can be seen clearly below the surface of the sea. The ridge of high ground upon which the harbour was built is formed of limestone similar

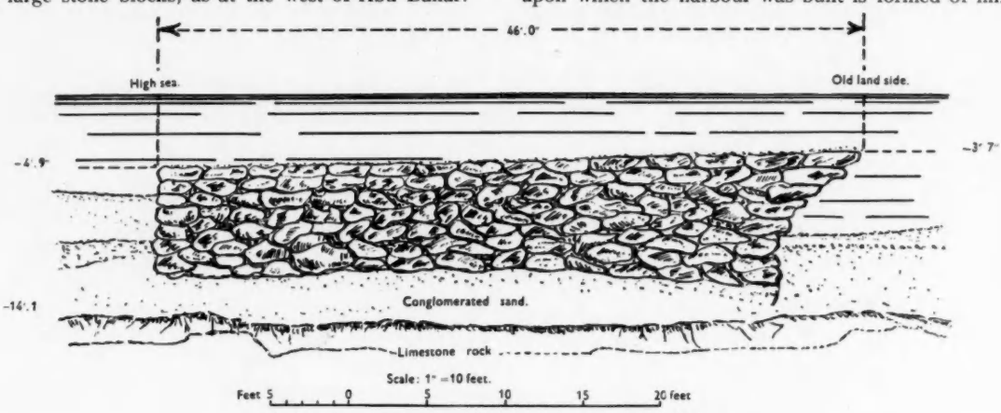


Fig. 3. Cross-Section of Landing Quay, Port of Pharos.

At the extremity of the point of Ras el Tin, near the main entrance to the inner basin, is a small island around which are the remains of other works, including a short mole which enclosed a small private dock—perhaps for the use of craft owned by the harbour authorities. This surmise is made the more probable by the fact that slightly to the north-west are the submerged ruins of a large building, more than 92-ft. long by 46-ft. wide, with approach channels and steps, which appears to have been the headquarters of the port management, where pilots and the captains of ships would come to receive their orders.

To the east of the great harbour was a smaller one occupying the Bay of Anfouchy. It also was protected by breakwaters and equipped with quays, but it afforded only a shallow depth of water and was used chiefly as a fishing centre.

I have attempted to give a brief description of the ancient harbour of Pharos, as revealed by the researches of M. Gaston Jondet, carried out between 1910 and 1915; and when the science shown in its layout and construction is considered, we must, I think, agree with him that it was, indeed, the work of a realistic genius.

It may seem strange that when Alexander the Great founded Alexandria and built his harbour in 332 B.C. he should have taken no notice of these wonderful works. The reason was that they had disappeared under the sea, and all that marked the site of the future city was a little village at Rhacotis and a small colony of fishermen. There is no more record of its fall than of its rise. Homer may refer to it in the fourth book of the "Odyssey," where he describes Pharos as an island in the troubled sea having within it a haven with fair moorings. If this is so, then its decline must be dated some time after 1000 B.C.

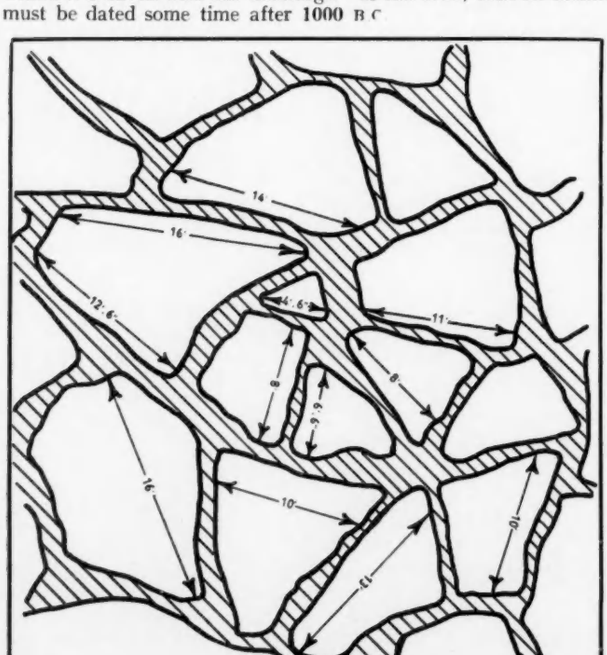


Fig. 4. Paving Stones of Pharos' Quays.

to that exposed in the quarries of Mex. Overlying the slopes of this ridge is a thin layer of clay, upon which is a thick layer of silt in various states of consolidation. Covering this on the higher slopes is the stratum of hard argillaceous sand, and it was upon this that the walls and breakwaters were built. M. Jondet considers that, as the silt consolidated, its bearing value weakened and the stratum of sand which rested upon it glided down the slopes in sudden subsidences, the underlying clay acting as a sliding surface. The process was purely mechanical, although earth tremors may at times have started the movement. In this manner whole portions of the works glided below water-level, often without any damage to their structure.

The Harbour of Alexander the Great

Fifteen hundred years after the foundation of the Harbour of Pharos, Alexander the Great, returning down the Canopic branch of the Nile from his visit to the temple of Zeus Ammon in the oasis of Siwah, halted at the village of Rhacotis. Ever since his destruction of Tyre he had determined to build a harbour that should be her rival. At Rhacotis he had found the place he wanted. He, himself, is said to have traced the plan of Alexandria and its harbour, which his famous engineer, Dinocrates, was ordered to carry out (fig. 6). The main feature of the harbour was the great mole, 600-ft. wide and 7 "stadia" (about 1 mile) in length, and hence called the "Heptastadion, from the mainland to the Island of Pharos, which divided the roadstead into two basins. It was built in a depth of water of 36-ft., and its construction entailed the excavation, transport, and deposition of about two million cubic yards of stone. The basin on the right of the mole formed the Great Harbour, and that on the left the "Eunostos" or Haven of Happy Return. Two openings through the mole connected them, thus conforming to the ancient rule that a harbour should have two entrances. The Great Harbour was bounded by the Lochias headland, the "Heptastadion," and the eastern end of the Island of Pharos. Seaward it was protected by a pier built out from Lochias and by a line of dangerous reefs, which made entrance to the harbour difficult. It was chiefly to remedy this that Ptolemy built the world-famous Pharos, or lighthouse, one of the seven wonders of the world, on the eastern point of the island. Alexander erred

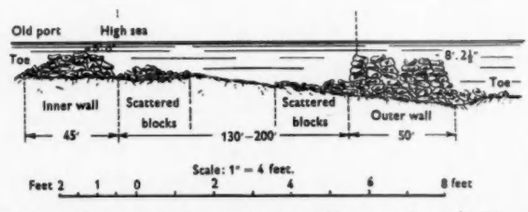


Fig. 5. Typical Section of Great Breakwater, Port of Pharos.

in putting his harbour in this place, since the depth of water was not so good as in the neighbouring haven, the reefs and Lochias pier did not provide sufficient protection against the winds, and the entrance was always difficult. Within the Great Harbour lies the small island of Antirrhodus, and between it, the mainland, and Lochias was formed a small "Portus Regius," or Port Royal, for the king's ships. Between the "Portus Regis" and the "Heptastadion" the shore was lined with quays and store-houses. The public granaries were on the "Eunostos," where

Ancient Harbours—continued

also was a small inner harbour enclosed by piers. It was on this basin that the important canal connecting the harbours with Lake Mareotis and the Nile, by its Canopic branch, opened. Alexandria partially fulfilled its founder's purpose of crippling the trade of Tyre; but this was due to the policy of Ptolemy Philadelphus (285-247 B.C) who made a harbour at Berenice on the Red Sea, connected it with Coptos, on the Nile, by a road provided with water places at proper stages, and reopened the canal between the Nile and the Red Sea at Suez. Thus he captured for Alexandria the important trade of the Indian Ocean and the Red Sea, which had hitherto passed by Eloth and Eziongebir to the coasts of Palestine, whence it was carried in Tyrian ships over the whole of the then known world. Alexandria's gain was Tyre's loss.

A period of more than 2,000 years passes (fig. 1). In the meantime the sand, which the engineers of ancient Pharos had been so careful to fend from the entrance to their harbour, had passed along the roadstead and had been caught up by the "Heptastadion." Gradually it broadened until it formed that belt between the waters upon which a large portion of the modern city of Alexandria is built. The engineers of 1870 discarded Alexander's great harbour, which had been for many years too difficult and shallow for shipping, and the entrance to which was still dangerous and difficult to make. They returned to the western side of Pharos and their great breakwater, like the south mole of the ancient harbour, was based on Ras el Tin. The modern harbour occupies what was the roadstead of its predecessor of 4,000 years ago.

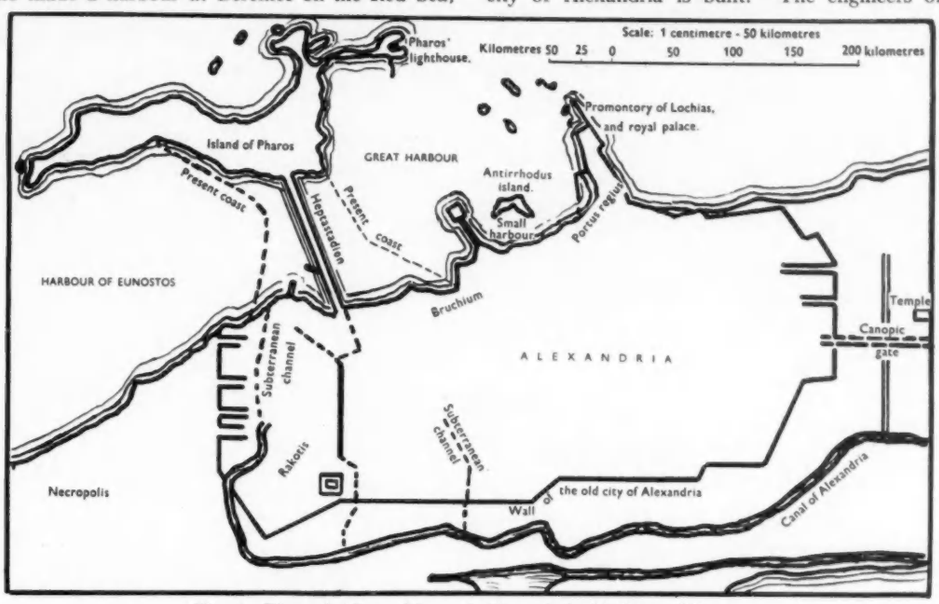


Fig. 6. Plan of Alexandria and Alexander's Harbour, 332 B.C.

(To be continued).

Port of Rangoon

Annual Report for 1939-40

Shipping and Trade Returns

According to the report for the administrative year 1939-40, ended 31st March last, recently issued by the Commissioners for the Port of Rangoon, 1,518 vessels, of 4,265,561 tons net, arrived during the 12 months ended March 31st last, as compared with 1,584 vessels, of 4,311,002 tons net, in the previous 12 months. Departures were 1,519 vessels, of 4,265,549 tons net, against 1,586 vessels, of 4,325,024 tons net. Imports during the period under review amounted to 1,388,839 tons (1,365,873 tons), exports to 3,994,522 tons (3,919,662 tons) and transhipment cargo to 47,904 tons (45,314 tons). These cargo traffic figures are the highest for the past five years.

New Works

The following are some of the more important new works in progress or completed during the 12 months. At Brooking Street Wharf the erection of four of the eight 30-cwt. cranes was completed in April and the remaining four by the middle of July, 1939. The 40-ton crane was delivered in July and erected by the end of November, 1939. Following the completion of Brooking Street Wharf the Commissioners, in continuation of their programme of wharf reconstruction, sanctioned in July, 1939, an expenditure of Rs. 71,50,000 for the replacement of berths 1-3, Sule Pagoda Wharves, the design being generally similar to that of Brooking Street Wharf.

The early portion of the year was occupied in putting down test cylinders, erecting temporary office buildings, clearing the site by demolition of old transit sheds and other buildings, laying down temporary sidings and dismantling the existing wharf head, including the extraction of the old screw piles. This was completed in September. A start was then made with the manufacture of the concrete piles and by December a total of 392 piles, representing the first stage of the work, had been manufactured and driven. The work of sinking the screwcrete cylinders to support the wharf head was started in February and satisfactory progress was being made at the end of the year. Work was also proceeding satisfactorily with the wharf decking and beams, and 90 per cent. of the requirements of precast "A" frames and wallings for the first berth had been manufactured. Some delay was caused towards the close of the year by the difficulty experienced in obtaining prompt delivery of steel for reinforcement and for the construction of the transit sheds.

Godowns

Godowns Nos. 58 and 58a have been reconditioned, part of godown No. 58 being dismantled and reconstructed. Work was proceeding at the end of the year on the construction at an estimated cost of Rs. 20,540 of two new godowns, each 50-ft. by 50-ft., this being part of a scheme to provide six additional godowns as an extension to those in Block "C."

An extension has been made to the waiting room at the Port Health Station at a cost of Rs. 7,529 in order to provide additional shelter from sun and rain to the large numbers who assemble on the arrival and departure of vessels carrying deck passengers.

The quarters for the port police at Botataung, which were commenced in August, 1938, were completed during the year at a cost of Rs. 4,40,315. Accommodation is provided for 12 European sergeants, one inspector, five sub-inspectors, six head constables, 48 married constables and 42 single constables. Two blocks of quarters for menials were constructed during the year. In addition, the lascars' quarters at Brooking Street, originally built in 1920, were reconditioned during the year at a cost of Rs. 7,727.

The Falsterbo Canal.

It is reported that good progress is being made on the construction of the new ship canal across the Falsterbo Peninsula in Southern Sweden. The work was undertaken some months ago in consequence of the closure by German minefields of the outer coastal route. No vessel drawing more than 4.6 metres in the loaded condition could round the headland inside Swedish territorial waters, with the result that most foreign-going vessels had to discharge their cargoes, which were then forwarded by rail or small coasting craft involving considerable expense for freight. transhipment and demurrage. The Riksdag, accordingly, made a grant of 19 million kroner to cover the cost of the Falsterbo inland waterway and of a deep-water channel through the Kalmarsund, on the Eastern side of South Sweden.

The Evolution of the Port Authority Plan in American Administrative Law

By JULIUS HENRY COHEN,
General Counsel of The Port of New York Authority*

DURING twenty-three years of association with the creation and organisation of The Port of New York Authority, I have heard many questions concerning the nature of the Authority.

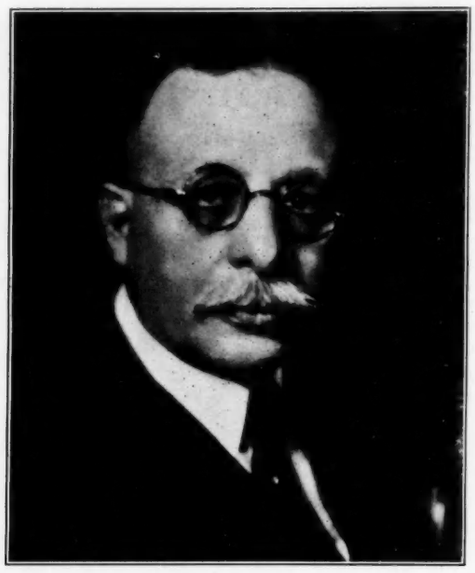
" Is the Port Authority responsible for the collection of import duties? " " What are the charges for piloting the ' Queen Mary ' into dock? " " How much does it cost to illuminate the Statue of Liberty? " These and many similar questions indicate clearly that the lay public is unfamiliar with the functions or nature of the port agency, which they, through their legislatures, have created.

Indeed, a friend of long standing who had just disembarked from a Transatlantic liner 'phoned one of our staff one day to protest against the delay she was put to in clearing her baggage through Customs. After her severe criticisms had run their course, the member of the staff courteously and patiently tried to explain that the Port Authority was a bi-state agency and in no way responsible for the examination—as it had no jurisdiction whatsoever over the collection of Federal Customs.

" But," she interrupted, " if you are the Port Authority I can't see why you don't have authority over the port."

Without a knowledge of its history, and hence no real understanding of its controlling factors, her inference was not entirely unjustified.

This evening, therefore, I want to devote myself to a rather full discussion of the history of the evolution of the Port Authority. It is only by so setting the stage with the appropriate scenery and props that I can explain the Port Authority to you as an administrative agency. Before discussing the evolution of the Port Authority idea, I should like to tell you of an interesting incident out of which the " Authority " name has grown.



Mr. JULIUS HENRY COHEN.

Some years ago, in England, a bill for the unification of the various agencies having jurisdiction over the Thames River and the London Docks had been drafted and approved. The decision to create the new body had been made. Then came the question, " What is to be the new body's name? " Lloyd George—the draftsman—rose to the occasion.

" This is a lengthy bill," he said. " Practically every sentence grants authority to do something. There is authority to do this, there is authority to do that and there is authority to do the other thing. Why not call it ' The Port of London Authority '? "[1]

That, very simply, is the historic origin of the name " Port of London Authority." In our own case, the name was borrowed from the Port of London Authority, notwithstanding our powers were never considered as identical."[2]

Why do we have a Port Authority?

So much for the origin of the " Authority name." But " Why," you well may ask, " do *we* have a Port Authority? " Here is the answer: If you look at a map of the Port of New York and forget the state and local boundaries, you will see one of the greatest natural ports of the world. You will see a magnificent waterfront of some 900 miles,[3] as well as an inner water belt line. You will see spread before your eyes a port into which you can and do pilot the world's largest and greatest vessels of all times.

However, while providence created one of the world's greatest harbours in this region, man himself drew a line through its centre. On each side of man's arbitrary fence are two independent sovereigns. Each of these sovereigns has created a number of local sub-divisions within its own territory and thus further sub-divided the port. As the map now shows there is a whole series of criss-cross boundary lines of cities, towns, villages, districts and counties.

The New Jersey side of the harbour is sub-divided into some forty municipalities. On the New York side there are, in addition to New York City and its boroughs, Yonkers and adjacent communities to the north along the Hudson—as well as New Rochelle and its adjacent communities on Long Island Sound.

Many more residents commute from their homes in New Jersey to their place of business in New York than do those from Long Island, Westchester and adjoining Connecticut.

The City of New York serves northern New Jersey—as well as the entire eastern part of the United States—as a financial, shopping and amusement centre.

A great majority of the railroad freight to and from New York is handled by the great trunk line carriers which have their termini in northern New Jersey.

Hence, there grew up, in spite of political dividing lines, a well-knit community bound by social and economic interests which make this great metropolitan district a social and economic unit.[4] But despite the fact that both sides of the port are irrevocably tied together by economic interests that will not be severed by merely artificial barriers,[5] this very element of divided authority periodically produced many sharp conflicts of opposing local interests. As Messrs. Frankfurter and Landis wrote in 1925, " controversy over the spheres appropriate for action by States or Nation began in 1789; it is rife to-day."[6]

As lawyers, and students of law, you are familiar with the great dispute which grew out of the grant to Robert Fulton by the State of New York of an exclusive monopoly for the operation of steamboats on the common waters of the port.[7] Out of it came that landmark of constitutional decisions by the Supreme Court—*Gibbons v. Ogden*.[8]

But, in addition, there arose innumerable boundary disputes and arguments over marine police jurisdiction. These were so incessant as to justify calling them " little wars." As every war is settled, these too were ultimately disposed of by a Treaty. I refer to the Treaty of 1834 between New York and New Jersey.[9] Subsequently, however, there were clashes between the two states. One was over sewerage disposal,[10] an argument only recently terminated in another Supreme Court decision. Another was over water supply.[11] But perhaps the bitterest of all was a clash over freight rates.

It required the World War, however, when the port was jammed with war-time traffic, to focus the attention of both states upon the aggravating conditions which came from this very division. In the " New York Harbour Case,"[12] New Jersey asked the Interstate Commerce Commission to grant lower freight rates to and from the interior of the country to points in New Jersey than those applicable to New York City.[13]

The publicity given to the case was provocative of much thought on the whole subject of port organisation. As a result and even while the case was still pending, there gradually emerged the basic and controlling conception that the two states could gain more through co-operation with each other than through litigation. In New York the feeling grew that the Empire State could no longer afford to regard the portion of the port within its own state lines as constituting the entire port. New Jersey was, indeed, a partner. There arose in both states a clean-cut determination to do something toward solving the common problem of port organisation and development through co-operation.

The Bi-State Port and Harbour Development Commission

And so it came about that in 1917 Governor Edge, of New Jersey, and Governor Whitman, of New York, appointed The New York, New Jersey Port and Harbour Development Com-

*A Lecture delivered at the New York University School of Law, on March 13th, 1940.

[1]For Footnotes see end of article.

Evolution of the Port Authority Plan in American Administrative Law—continued

mission.[14] The bi-state commission was organised at first simply to study the problem of co-ordinating port and harbour development for the two states as a whole, and find a way for doing it.

Almost immediately after its appointment the Commission,[15] with the aid of Major-General George W. Goethals, of Panama Canal fame, and B. F. Cresson, Jr., as Consulting Engineer and Chief Engineer respectively, commenced an exhaustive investigation of port conditions. By December, 1920, the Commission was ready to recommend a definite plan for the development and improvement of the port.[16] Its " epitomized recommendations " were

> " I. Adoption of a compact between the States of New York and New Jersey providing for
>
> (a) Creation of a single Port District;
>
> (b) Administration by a single Port Authority."

There were other recommendations which I need not go into at this time. They included a Comprehensive Plan of port development which contained certain detailed principles for port development.[17] The difficulty two sovereign states found in trying to solve a common problem by litigation was illustrated in the sewerage case. As the Supreme Court itself pointed out in 1922:—[18]

> " We cannot withhold the suggestion, inspired by the consideration of this case, that the grave problem of sewage disposal presented by the large and growing populations living on the shores of New York bay is one more likely to be wisely solved by co-operative study and by conference and mutual concession on the part of representatives of the states so vitally interested in it than by proceedings in any court, however constituted."

Contrariwise, the sewerage case illustrated the soundness of the co-operative method which the bi-state commission recommended.

The development and improvement of the port as a whole obviously required the creation of a continuous and creative administrative body. How was this continuity of action to be brought about? It was clear that no simple solution would do. The problem was full of legal as well as political difficulties.

The bi-state Commission decided and urged upon the states that the *implicit* obligation of the legislation under which it was created and had acted should be reduced to the form of an agreement, the terms of which should be explicit and definite. This is how it came about that the lawyers were challenged to explore the compact-making powers of the states as a possible solution of the problem.[19]

The Commission, having determined what the states might do with respect to a physical plan for port development, directed their attention, as they were required to do, toward formulating a legal plan. Because the port was divided—as we said—into a score of separate municipalities, it was obviously impractical to select any *one* of the municipalities within the district to act as the agent, nor to do anything which would override their initiative in developing their own particular localities. Indeed, the scheme had to be one to encourage and to assist them.

Several methods were to be considered. The states might have created a private corporation.[20] They might have created a corporation under the stock corporation laws and owned and controlled all of the shares of stock. Precedent for this could be found in the creation of the Emergency Fleet Corporation by the Federal Government, and other similar federal war emergency corporations.

Another method would have delegated the power to existing state departments, one in each state. A third method would have been to create two independent state commissions, as was originally done in the case of the Palisades Interstate Park Commission.

But the advisers to the Port and Harbour Development Commission were of the mind that the *best* results could be secured through a single *joint* agency.[21] Accordingly the creation of such an agency was made one of the main recommendations. Since that time the experience of the Port Authority led the two states to follow its example by creating a single agency for the continuance of the Palisades Park Development.[22]

Finally, in 1921, after public hearings, the legislatures of the two states authorised the Bi-State Port Commissioners to sign the Treaty on behalf of the two states.[23]

The 1921 Port Compact

The 1921 Port Treaty, or Compact, by its express terms, signed April 30th, 1921, supplements and amends the 1834 Treaty. In the latter Treaty the States of New Jersey and New York fixed and determined " the rights and obligations of the two states in and about the waters thereof and especially in and about the Bay of New York and the Hudson River."

The recitals in the 1921 Treaty disclose the controlling objectives. In them, the states recited and declared that " a better co-ordination of the terminal, transportation and other facilities of commerce in, about and through the Port of New York will result in great economies, benefiting the nation, as well as the states of New York and New Jersey." Also that the " result can best be accomplished through the co-operation of the two states by and through a joint or common agency."

In Article I the states agreed and pledged

> " each to the other, faithful co-operation in the future planning and development of the Port of New York, holding in high trust for the benefit of the nation the special blessings and natural advantages thereof."

Thus, the states entered into a compact to co-operate in the co-ordination of all terminal, transportation and similar facilities of commerce within the district.

As the first step in the plan for co-operative action, the two states marked out and delineated a district which they designated the " Port of New York District." This district is described with particularity by metes and bounds. But you will note that this district, unlike other Port Districts, is not an incorporation of inhabitants:[24]: The Port of New York District is simply an area within which the states have agreed to co-operate in developing a co-ordinated plan of port development.

In the Treaty, after creating the District, the states provided for " The Port of New York Authority." This they established and declared to be a body corporate and politic. The Authority, as I shall point out later, consists of the Commissioners appointed from each state.

The Comprehensive Plan for Port Development

The Treaty, however, was merely the promise to co-operate. It did not set forth a definite plan. Accordingly, in it the two signatories covenanted[25] that the legislatures of the two states would adopt a plan or plans for the comprehensive development of the Port of New York. It provided: " In the event that a plan for the comprehensive development of the port shall not have been adopted by both states on or prior to July first, nineteen hundred and twenty-three " either state could withdraw from the Compact.[26] Despite much opposition in both states, however, a Comprehensive Plan was adopted within the next year—1922.[27]

Because it was developed in the closing years of the war at a time when railroad transportation was in everyone's mind, the emphasis in the Comprehensive Plan was heavily placed upon the railroad features of the plan.

As its backbone the Plan contemplated a system of railroad belt lines designed to reach all waterfront and industrial areas in the Port of New York District. As a necessary factor it included the railroad freight tunnel under the Bay from Jersey City to Brooklyn.

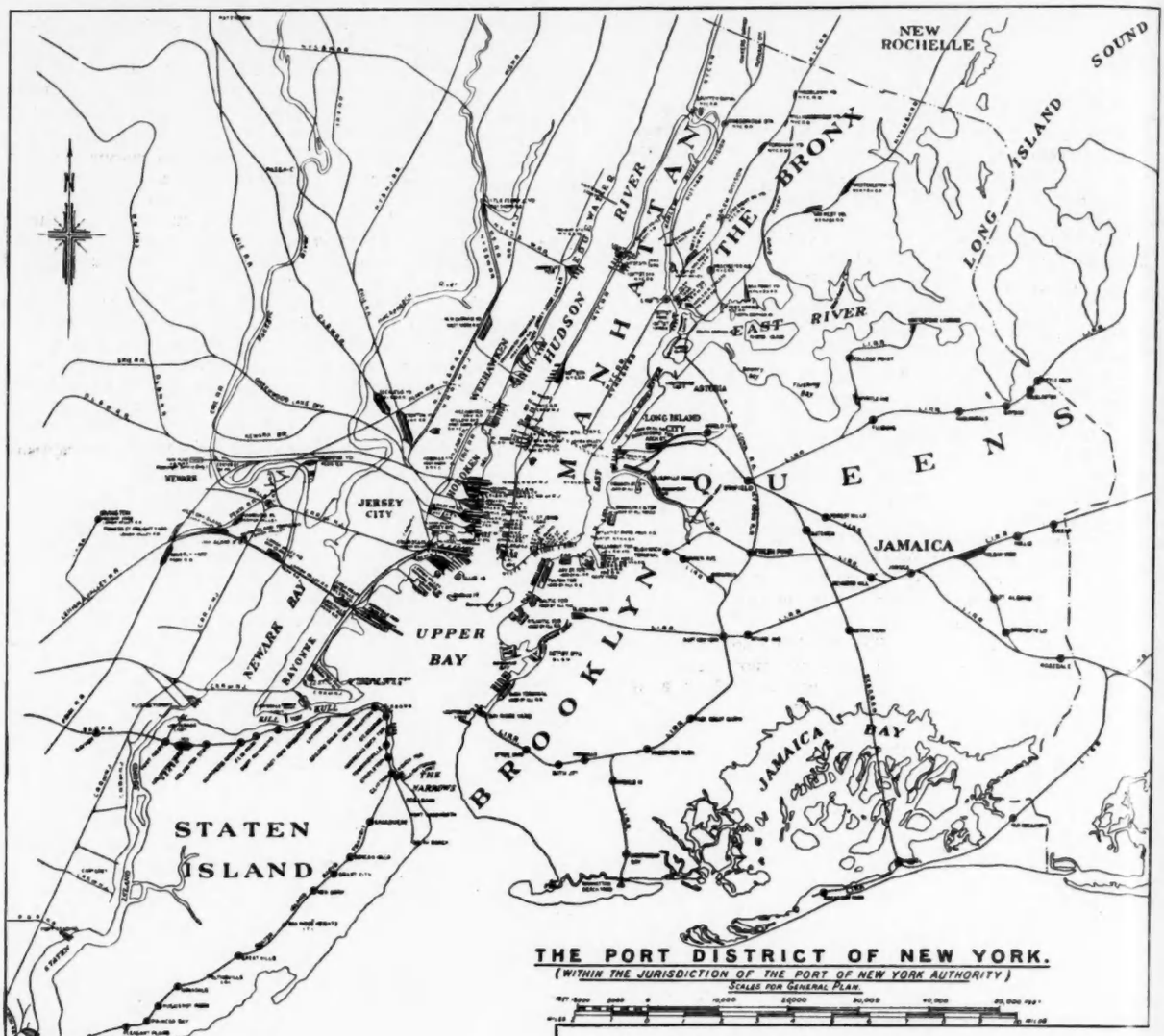
On the marine side of the rail transportation system it should be emphasised that the waterways of the port perform the same functions as do rail belt lines in other sections. Lighterage and carfloatage are mere extensions of rail line activities and are performing the functions of extensive land switching operations elsewhere. But in their water operations, each railroad, however, operated its own fleet in competitive terminal distribution service to 150 steamship piers and countless waterfront industries. The Comprehensive Plan therefore looked toward the consolidation of all railroad marine departments into a union marine operation to function as does a union terminal railroad.

So much for the rail and water problem. Because of the inordinate volume of traffic, its insular position and crowded streets, Manhattan presented the most difficult of all phases of the problem. Except for the freight which the New York Central brought into Manhattan via its Spuyten Duyvil route, all of the other freight had to be ferried across the waters of the port in car floats or lighters. In Manhattan, therefore, the Plan outlined a number of union inlaid freight stations. The location of these termini back from the waterfront was intended to release a number of piers for steamship use. Hence the term " Inland Freight Terminal." Finally, these Manhattan terminals were to be connected by an underground railroad, or some better method if it were found, with the transfer yards of each trunk line in the outlying districts.

The first of these freight terminals[28] (Port Authority Inland Terminal No. 1) has been constructed, though it differs in some respects from the original plan.[29]

While, as I have said, the emphasis on the plan in 1921-1922 was a railroad emphasis, a revolutionary change has taken place through the increased availability of the motor truck. By reason of the greater flexibility of such service, the motor truck began to pick up more and more less-than-carload (l.c.l.) freight. The silk manufacturer in Pennsylvania could call the New York market, purchase raw silk at 4 p.m. on Monday and have it delivered ready for work at his plant by 6 a.m. of the next day. This flexibility of the service has a distinct appeal to business men. This is why, in the past two decades sporadic, localised truck operations have developed into a whole network of transcontinental truck lines operating as common carriers on schedule and with all of the efficiency of a co-ordinated transportation system. This, in turn, brought about the extension of the Interstate Commerce Commission's jurisdiction so as to embrace this newest phase of both passenger and freight transportation.

Evolution of the Port Authority Plan in American Administrative Law—continued



To-day you will find that a substantial part of the freight which formerly travelled in and out of the Port of New York by lighters and on to railroad freight cars is now moved by truck.

And as the trend shifted to a greater use of motor vehicles, the Commissioners of the Port Authority caught the trend and they embarked upon a vehicular crossing programme.

I have gone into these non-legal phases in some detail, because without them no one can get a realistic approach to the legal administrative problems we have to face. These, as I have said, constitute the scenery and props without which we can hardly understand the Port Authority.

The Legal Status of the Port Authority

Now let us examine the Port Authority itself—its legal status—and then examine the administrative machinery by which it functions.

It is important to remember that the Port Authority is a bi-state agency. It is important because much of its strength and some of its weaknesses stem from the fact that it represents "two sovereign states." You will recall that the agency was created to the end that the states might carry out their sovereign pledge of continuous co-operation in the port district. Hence each of these parties has an equal, undivided, interest in the agency.

Of course, in representing the States of New Jersey and New York, the Port Authority does not represent the City of New York, or for that matter, any other city in the two states. It should not, therefore, be confused with such agencies as the Triborough Bridge Authority or the New York City Tunnel Authority. These operate under the control of and represent the policy of the City of New York alone.

The simple fact is that the Port Authority is a direct arm or adjunct of two states created to operate within the sphere of port development within a defined area.

At this point, we may ask, "Just what is the Port Authority?" The answer is to be found in the Port Treaty. The Port Authority consists of twelve Commissioners, six appointed from each state, as the Legislature of each state may provide. The law in each state vests power of appointment in the Governor. These twelve Commissioners, in the terms of the Treaty, constitute "a body corporate and politic."

Each Commissioner serves a term of six years without salary and the terms are staggered so that there is one expiring term each year in each state.

As an indication of the continuity of office in the Commission, and the favour with which its work has been received by succeeding Governors, it may be pointed out that the present Chairman of the Port Authority, Frank C. Ferguson, has been a Commissioner for sixteen years. Likewise, Howard S. Cullman, its Vice-Chairman, has been on the Commission for thirteen years. Commissioner Alexander J. Shamberg served on the New York State Bridge and Tunnel Commission from 1906 and came to the Port Authority when the Port Authority took over the Holland Tunnel in 1930, and continues to serve; Commissioner George deB. Keim has served since 1930; and Commissioner John J. Pulleyn, who first served on the New York State Bridge and Tunnel Commission from 1928 has been a member of the Port Authority since 1930 (several times reappointed).[30] Among its present members there are included former Governor (New York) Charles S. Whitman; United States Commissioner of Immigration Rudolph Reimer; former Comptroller of the City of New York, Frank J. Taylor; Joseph M. Byrne, Jr., member of the Board of Commissioners of the City of Newark (Director of Parks and Public Property); Raymond M. Greer, Finance Officer of the City of Jersey City and John Borg, Editor and Banker, serving since 1938.

Indeed, it is simple truth to say that whatever success the Port Authority has enjoyed is due almost entirely to the fact that it is administered by Commissioners of outstanding capabilities and of high character and reputation.[31] It is interesting to note that Governor Smith, who was Governor when studies were made prior to signing the 1921 Port Treaty, was subsequently appointed and served as a Commissioner of the Port Authority under the appointment of Governor Miller, in whose term the Port Treaty was signed. Several years ago Governor Lehman appointed ex-Governor Charles S. Whitman to the Authority in whose term the prior Bi-State Commission began its work.

Evolution of the Port Authority Plan in American Administrative Law—continued

Thus you see that the Port Authority has been fortunate in securing highly experienced and capable men who have been at all times willing to serve the two states diligently and without remuneration and who have brought to the Port Authority not only experience in public affairs but training in the law and in finance, and by their high personal character have established the fine reputation now enjoyed by the Authority. Besides there has been continuity of service insuring a fund of special experience in the handling of Port Authority problems.

Administration of the Port Authority

The Commissioners elect their own Chairman. They function in a large measure as would a board of directors of any large corporation in whom is vested the legal authority and responsibility for the acts of the corporation. The chief difference between the operation of a private corporation and the Port Authority is in the relation of the Commissioners to the Governors of the two states and in the requirement that a certain number of votes from each state are required, as I shall point out.

The Commissioners, as I have indicated, are appointed by the two Governors. Since they constitute an agency of the state, they must look to their principals for instructions. These instructions take the form of legislative mandates.

Pursuant to the provisions of the Compact the Port Authority reports annually to the Governors of New York and New Jersey. These reports are public documents and through them the Governors and legislatures of the two states are fully informed as to Port Authority activities.[32]

In addition, however, the statutes provide that the Secretary of the Port Authority shall transmit to the Governor a certified copy of the Minutes of every meeting as soon after the holding of such meeting as such Minutes can be written out. The Governor shall, within five days[33] after such Minutes shall have been delivered, cause the same to be returned to The Port of New York Authority either with his approval or with his veto,[34] provided, that if the Governor shall not return the Minutes within the period, then at the expiration any action therein recited will have full force and effect according to the wording thereof. Thus you see that the Commission reports all of its actions directly to the two states in the persons of the respective Governors.

In this connection you will be interested in the provisions of Article XVI of the Treaty, which provides that "no action of the port authority shall be binding unless taken at a meeting at which at least three of the members from each state are present and unless the majority of the members from each state present at such meeting, but in any event at least three of the members from each state, shall vote in favour thereof." This provision springs only from the fact that the Port Authority is bi-state in character and its legislatures were careful to provide that each of the two states be represented at any meetings at which binding action might be taken. However, in the nineteen years during which the Port Authority has functioned as an entity, there has never been an occasion where the Commissioners of one state sought to take action which was not in the interest of the Port as a whole.[35] The Commissioners regard themselves as neither New York or New Jersey members in exercising this judgment,[36] but as Commissioners for the whole Port District carrying out the mandate of the two states.

Though the Board of Commissioners meets regularly its detailed work is carried out through twelve committees,[37] each of five Commissioners. These Committees cover the entire range of subjects with which the Commission has to deal. These committees meet and receive reports and recommendations from the staff. If approved, the staff reports are submitted with Committee recommendations to the full Commission for final action.

The body functions through a General Manager who is administrative head of the staff and through a General Counsel who is the legal adviser of the Commissioners as well as the management. Over a period of nineteen years the staff has been built up of persons selected for their expert knowledge or special qualifications in their respective fields.[38]

Over a period of from ten to nineteen years, department heads have risen from the ranks within the organisation, such promotions having been made on the basis of merit and proven ability. And although the Port Authority employees are not subject to Civil Service requirements, the Commissioners have established the policy of permanency of tenure during good behaviour.[39]

(To be continued).

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[1]This story was told to me by Lord Devonport, Chairman of the Port of London Authority, in London, in 1924

[2]Both Authorities are public corporations; both are subject to the ultimate potential control of the legislative parent—Parliament in one case and two State Legislatures in the other. Both are governed by commissions appointed by the parent, and both are engaged in performing governmental functions on a financially autonomous basis. In other respects, however, the authorities differ greatly. For an interesting discussion of the Port of London Authority, see Lincoln Gordon, "The Public Corporation in Great Britain," p. 18, "et seq."

[3]As contrasted with New York, Boston has approximately 141 miles of waterfront, Baltimore 120, Philadelphia 37, Norfolk 26, New Orleans 41, San Francisco 8, Galveston 8 and Seattle 140.

[4]See Bush Terminal Co., et al., v. The City of New York," decided by the Court of Appeals, March 5th, 1940: "The Port of New York is commercially a single district, though it lies partly in New Jersey, and many local governmental units or municipalities are contained in it. The freight terminals of almost all the railroads which serve the port are on the New Jersey side of the Hudson River and the most important business and industrial centres of the port are in New York."

[5]See the "New York Harbour" case, "infra," n. 12.

[6]Frankfurter and Landis, "The Compact Clause of the Constitution —A Study in Interstate Adjustments," 34 Yale Law Journal 685 (1925).

[7]McMaster's "History of the People of the United States," Vol. III, p. 488, "et seq."

[8]Wheat. 1.

[9]New York, New Jersey Port and Harbour Development Commission, Joint Report with Comprehensive Plan and Recommendations, 1920, pp. 41-42. The text of the Treaty is set forth at p. 42.

[10]"New Jersey v. City of New York," 283 U.S. 473 and "New York v. New Jersey," 256 U.S. 296.

[11]"New Jersey v. New York," 283 U.S. 336.

[12]The proceedings before the Interstate Commerce Commission was officially known as "New York Harbour Case," No. 8994.

[13]A more detailed history of the case may be found in the Joint Report, "supra," n. 9, at 52.

[14]Chapter 426, Laws of New York, 1917, Chapter 130, Laws of New Jersey, 1917.

[15]The members consisted of William R. Willcox, Chairman, Eugenius H. Outerbridge and Murray Hulbert, appointees to the New York Commission and J. Spencer Smith, Dewitt Van Buskirk and Frank R. Ford appointees from New Jersey.

[16]The Report of the Bi-State Commission, the Court of Appeals has pointed out "throws light upon the meaning and intent of the compact between the States." See "Bush Terminal Co., v. The City of New York," (decided March 5th, 1940).

[17]These are set forth in detail at pp. 38, 39 and 40 of the Joint Report, "supra."

[18]"New York v. New Jersey," 256 U.S. (1922) at 313.

[19]P. 10, Article I of the Federal Constitution.

[20]It has been held that both state and federal authority might be exercised through the medium of a private corporation: "California v. Central Pacific Railroad Co." 127 U.S. 1 (1888):"Luxton v. North River Bridge Co.", 153 U.S. 525, 529 (1894); "Wilson v. Shaw," 204 U.S. 24 (1906); "Stockton v. Baltimore and New York Railroad Co.", 32 Fed. 9 (1887).

[21]Just recently the Court of Appeals, in "Bush Terminal Co. v. The City of New York" (decided March 5th, 1940), said: "The State of New York, or an agency exercising only powers which the State of New York could confer upon it, could not, acting alone, solve the problems connected with the efficient development and regulation of the commerce of the port, nor could the State of New Jersey or an agency acting under authority conferred by that State."

[22]Chapter 148, Laws of New Jersey, 1937; Chapter 170, Laws of New York, 1937.

[23]Chapter 154, Laws of New York, 1921; Chapter 151, Laws of New Jersey, 1921.

[24]This is to be contrasted with the enabling legislation under which the Albany Port District Commission was created (Chapter 192, Laws of New York, 1925). Reference to that statute shows clearly that the port district itself is incorporated. In this respect the Albany Port District closely resembles a municipal corporation which the Appellate Division has declared to be within the terms of the New York Lien Law. See "Callanan Road Improvement Co. v. McMullen and Co.", 253 App. Div. 424, affirmed 280 N.Y. 536, without opinion. But of "Bush Terminal Co., v. City of New York, supra," C. 4 to the effect that the Port Authority is not a municipal corporation in the strict sense.

[25]Article X.

[26]Article XXI.

[27]Chapter 43, Laws of New York, 1922; Chapter 9, Laws of New Jersey, 1922.

[28]For an interesting discussion of this terminal see the opinion of the Court of Appeals in "Bush Terminal Co. v. The City of New York" (decided March 5th, 1940).

[29]As originally planned, this union station was to be the first of several in a plan for wholly revamping freight service for Manhattan Island. It contemplated also a system of storedoor delivery, union perishable terminals on the waterfront, and the gradual wholesale elimination of railroad use of piers. But instead of hauling all their freight directly between the Union Inland Freight Station and the New Jersey railheads, the carriers are still floating much of it to their pier stations in the old manner and then trucking to the Inland Station, which results in a double handling and an obviously higher cost. This much has been accomplished. L.c.l. freight for all of the trunk line carriers may now be picked up and delivered to a single depot. Instead of a Woolworth truck, for example, picking up freight at the Erie, Central, D. L. & W., and other railroad pier stations, making interminable stops at each, it can pick up or deliver freight to all of these railroads by making one stop at the Inland Terminal No. 1.

[30]Besides the foregoing, the Port Authority has also had—always without salary—the valuable services of such men as Eugenius H. Outerbridge, President of the New York State Chamber of Commerce, after whom the bridge from Staten Island to New Jersey was named and who was the Authority's first Chairman; Brigadier-General George R. Dyer, who was Chairman of the New York State Bridge and Tunnel Commission and served as Chairman of the Port Authority from October 19th, 1933, until his death on August 31st, 1934; Herbert K. Twitchell, President of the Seamen's Bank for Savings, who served from 1924 until his death in 1928; former Governor George S. Silzer (New Jersey), who served as Commissioner and as Chairman of the Port Authority from 1926 to 1928; former United States Senator John Milton (New Jersey) who served from 1933 to 1939; Michael F. Walsh, now Secretary of State of New York, who served from 1937 to 1938; John J. Quinn, new United States Attorney for New Jersey who served from 1932 to 1936; Julian A. Gregory, lawyer, who served as Chairman from 1924 to 1926; and Joseph A. Bower, Vice-President of the Chemical Bank, who served from 1936 to 1938.

[31]John F. Fowler, Jr., "Revenue Bonds" (Harper, 1938) says (p. 102): "The form of organisation of the Port of New York Authority has been cited as one which is designed to assure, as far as possible, independence from political interference."

Evolution of the Port Authority Plan in American Administrative Law—continued

On a number of occasions the press has commented on the fact that the work of the Port Authority has been singularly free from politics. Thus The New York Times (March 10th, 1937) said: "The annual report of the Port of New York Authority just submitted to the Governors and Legislatures of New York and New Jersey emphasises what can be accomplished by putting politics permanently on the shelf and attending strictly to business."

The New York Herald Tribune (September 28th, 1936) said: "The excellent financial condition of the Port Authority is gratifying from two points of view—from the point of view of the very large social investment its undertakings represent, and from that of the example it has set in the field of interstate co-operation. Such an agency might well have succumbed to political manipulation and either have embarked on uneconomic enterprises, to become eventually a burden on the taxpayer, or have suffered a stalemate through interstate jealousies. Instead, both New York and New Jersey have been careful to maintain a high average of personnel in their Port Authority commissioners, who in turn have conducted the Authority's affairs with as much regard to business justification as if they were the directors of a private corporation."

The Newark Evening News (March 10th, 1937) said: "At home we have the Port of New York Authority, an interstate agency conceded to have submerged sectional prejudices to make a fine job of a monumental task. The Commissioners of the Port Authority draw no salaries, but that has been no deterrent to their interest in developing the metropolitan district with a minimum of politics."

[32]" Bush Terminal Co. v. The City of New York " (decided March 5th, 1940).

[33]In New Jersey the period is ten days.

[34]The provision for veto by the Governors, I interpret as permitting the chief executives of the two states to nullify acts of the Commissioners which constitute malfeasance or misfaesance, or violate the spirit and letter of the treaty. As General Counsel of the Port Authority I have advised that the veto power does not permit the Governors of the two states arbitrarily or unreasonably to veto action by the Commissioners or merely because the Governor does not share the judgment exercised by the Authority. I believe that any other interpretation would do violence to the Treaty itself.

[35]It is interesting to note that when the Bi-State Port and Harbour Development Commission reported in its original 1920 Report, it quoted from the statement by the Honourable James A. Tawney, Chairman of the International Joint Commission (United States and Canada) in the " St. Mary's River " case:

> "This tribunal is also unique because composed of citizens of two independent sovereignties. . . Neither section of the Commission has any authority under the treaty to act in either country independent of the other. 'Each section acts in conjunction with the other as a joint international organisation.' In cases like the one now before us each member acts as the representative of 'both countries,' or as Mr. Commissioner Gore, of Massachusetts, in deciding a case arising under the Jay treaty for the settlement of questions growing out of the War of the Revolution, well said:
>
> 'Although I am a citizen of but one nation, I am constituted a judge of both. Each nation has the same right and no greater right to demand of me fidelity and diligence in the examination, exactness, and justice of the decision.' "

The Bi-State Commission then said:

> "This is precisely the attitude that we should like a Joint Port Authority to take, though receiving appointment, one-half of its members at the hands of the Governor of New York and one-half at the hands of the Governor of New Jersey."

(See Joint Report of N.Y., N.J. Port & Harbour Development Commission, at p. 464).

This is indeed the attitude which has since been consistently taken by the Commissioners of The Port of New York Authority.

[36]During one of the very early meetings of the Commission, the question arose as to whether the Commissioners from New Jersey and New York should sit at opposite sides of the table. Chairman Outerbridge ruled that they should not. It was his opinion that the Commissioners from the two states should not divide themselves by an arbitrary line through the centre of the table but rather that they should sit side by side alongside of their fellow Commissioners from the neighbouring state. This practice has continued through the present day and it has helped to establish the friendly feeling of co-operation, without regard to artificial state barriers, which has marked the work of the Port Authority Commission for the past nineteen years.

[37]Committee on Audit, Committee on Construction, Committee on Finance, Committee on Insurance and Claims, Committee on Public Agencies, Committee on Operations, Committee on Personnel, Committee on Port Protection, Committee on Publicity, Committee on Purchase, Committee on Programme and Work, Committee on Terminals.

[38]See an article from the December, 1933, issue of Fortune published in "The Roosevelt Omnibus," edited by Don Wharton (1934), stating (p. 122): "The United States with its hardly-won service covering postmasters and a few others must and does envy the British their impartial experts ready to serve any party in the interest of an efficient government. Nothing in America but the highly expert staffs of such semi-public bodies as the Port of New York Authority are in any way comparable to the British services."

[39]The Declaration of Policy of Tenure of office reads in part:

> "To insure stability and offer encouragement to our aids and employees, the Commission does now establish the 'principle of permanency of tenure during good behaviour'—now the policy applied in all well managed institutions, including governmental agencies both in this country and abroad, and in spirit heretofore prevailing in this institution—and guarantees to the members of its organisation that no one shall be removed from office or employment save upon charges duly given to him in writing, with ample opportunity to reply and to be heard (in the case of heads of departments by the Commissioners themselves, and in the cases of others by the heads of the departments, respectively, under whom they serve).
>
> "This privilege will be accorded to everyone who now has been in the service or hereafter will have been in the service for 'five or more years' (computing, in the case of former Holland Tunnel employees, the time of service with that Commission, in addition to the time of service with the Port Authority). This decision by the Board is subject always to such diminution of, and changes and transfers in personnel as may be required any time either by reason of termination of diminution or change of work (construction or operation) in which any part of the personnel may be engaged, or by reason of necessary public economy. The Board reserves the right always to abolish any position, to change its duties, or any salary attached to the position, or to transfer an employee, or to fix the age of retirement under regulations affecting membership in the Retirement Fund, and to determine the grounds for removal."

Recent Developments on the River Nile

At the meeting on December 17th of the Institution of Civil Engineers, a Paper was read by Mr. Alec George Vaughan-Lee, M.Inst.C.E., on " The Mohammad Aly Barrages, Egypt," in which operations are described in continuation of the programme of regulation works on the River Nile.

The Paper first reviews the chequered history of the Delta barrages, across the Damietta and Rosetta branches at the Southern apex of the Nile delta. The principal works, each of which is described in detail, comprised (a) reconditioning of the Tewfiki regulator and lock; (b) the new Damietta barrage and navigation lock; (c) an abutment at the West end of the Damietta barrage and a retaining abutment in connection with the old Damietta barrage; (d) an hydraulic research laboratory; (e) a swing-bridge across the Menoufia Canal; (f) reconditioning of the ancient gateway of the fortifications; (g) a new intake and a new regulator for the Nagayel Canal; (h) the new Rosetta barrage, with its abutment and a navigation lock; (j) a new diversion for the Behera Canal, with a regulator and a navigation lock; (k) about 4 kilometres of road, including two bridges over small canals; (1) sluice gates, lock gates, swing bridges, operating machinery, sluice valves and various fittings.

Most of the materials, with the exception of iron and steel work, were obtained in Egypt. Two large work yards were established by the Contractors, and a subsidiary yard for the storage of materials. Work was commenced in January, 1937, and was substantially completed by the contract date (the 15th December, 1939); the barrages were used for regulation in February, 1940.

Details are given of the mechanical equipment, all of which was obtained from Great Britain; all deliveries were up to time, so that delays were obviated. The principal particulars of the various sluice gates are tabulated, and their operation is described. Descriptions are also given of the groove castings for these gates, and of the operation of the gates by machines travelling on the superstructures of the barrages and regulators: those for the large gates are power-driven, and the smaller ones are operated by hand.

Each of the three large locks was equipped with mild steel gates operated by hand capstans working through bevel wheels in pits below the coping-level gearing; these capstans can be disconnected for warping vessels into the locks. A fourth set of gates was built at the Tewfiki regulator, to replace the old gates after 50 years of service. As no accurate drawings of the latter existed, surveys of the lock, the gates, and their recesses had to be made during the canal-closure period in January, 1938. Erection of the new gates was commenced in January, 1939, and was not completed until nearly the end of April, so that navigation had to be suspended for three months.

Each of the four locks is spanned by a plate girder swing bridge for road traffic, with roadways 19-ft. wide between curbs and two 4-ft. footpaths. These bridges rotate on a central pivot and a live ring, and are balanced so that half the swinging load rests on the pivot and half on the live ring.

The equipment of the hydraulic research laboratory comprises a number of large valves and penstocks for the various channels. One bronze-faced valve 1.2 metre in diameter was installed at the control chamber for the direct supply of water to the laboratory building through a Venturi meter, and two similar valves, 1 metre in diameter, were provided at the main outlet. For regulation at the control chamber three large cast-iron penstocks were necessary, whilst four smaller penstocks were installed in the measuring-tanks. All of these valves and penstocks were specified to take the full head of water on both sides.

The cost of the works covered by the contract was about £E2,405,000, including £E386,000 for the mechanical equipment.

The Roller Sluice Gates, with their power-operated machinery, for the Mohammad Aly Barrages, described in the Paper, were supplied under contract by Messrs. Ransomes & Rapier, Ltd., of Ipswich. The same firm have in previous years equipped the three other Nile barrages at Esna, Nag Hammadi and Assiut with similar sluice gates and operating machinery. Each of these barrages, including the Mohammad Aly Barrages, are provided with approximately 200 gates, varying in span between 5 and 8 metres. With the sluice and lock-gate installations previously carried out at Aswan and Sennar (in the Sudan), we are informed that practically the whole of the Nile is controlled by this firm's gates, others of which are installed for various purposes in many parts of the world.

*Navigational Fog Signals**

Discussion

Mr. T. J. Monaghan, B.Sc. (Member), proposing a vote of thanks to Mr. Tonkin, said that the Paper that had been presented to them by Mr. Tonkin described a very important and original work and it would undoubtedly be of considerable value in the Transactions of the Institution. He felt sure that it would be in demand by the experts of other administrations concerned with navigational signals and, of course, that demand would add not a little to the prestige of the Institution of Civil Engineers of Ireland.

He had read the Paper and the first point that struck him was that the frequency selected for the Bull Rock signals was remarkably low. The transmitter they were dealing with was of the siren type, an engineering piece of apparatus. The receiver of the signals was a very non-engineering piece of apparatus—a human being—and the question to be solved was, what were the characteristics of a noise which would travel through fog and attract the attention of a tired and weary master mariner.

Mr. Tonkin, in discussing that question, pointed out that the sensitivity of the human ear was much better at higher frequencies than the one selected for the Bull Rock. It was a matter of opinion whether the dissipation of sound in fog varied materially with the frequency. Possibly, that was one of the matters in regard to which Mr. Tonkin would be able to furnish them with information.

Thinking over the question of low frequency, he found two points which seemed to be in its favour. The first was that a low frequency from horns such as the ones used in the Bull Rock signals gave a more circular diagram than would higher frequencies. The higher frequencies would seem to have a marked directional effect and were not suitable for all-round signals. There was another feature which might be of importance. A low frequency, in his opinion, masked higher frequency noises, and the reverse did not apply.

He was very interested in Mr. Tonkin's Figure 3 in connection with which they found a rather mysterious word—at least he was inclined to think it was mysterious to many of them—and that was the unit "phons." The phon was a recently developed measure for noise. It was hardly necessary to tell engineers that noise was a matter of great importance in certain engineering applications. Mr. Tonkin represented about the only body of engineers to whom noise was really welcome; the rest of them were trying to get rid of it. Whether they liked or disliked it, they had to try to measure it and the phon had been developed in comparatively recent years in order to do that.

Mr. Tonkin had pointed out that the frequency of the sound had a great deal to do with its loudness, and of course loudness was what they were concerned with. Mr. Tonkin also mentioned that on board ship there was a noise level of at least 30 to 40 phons. The zero of the phon scale was the lowest sound one could possibly hear—the merest rustle of grass on the brightest and calmest sunny day. The maximum would be about 120 or 130 phons. It was at that stage that noise passed from the sensation of audibility into one of pain. On board ship they had a background of 30 to 40 phons and he would be inclined to say that that consideration, plus the curves given in Fig. 3, would bring the best frequency for the signal to somewhere in the neighbourhood of 250 cycles.

He understood from Page 99 of the Paper that the fact that it was difficult to get a sound wave in a siren was regarded as a matter for regret. But there were two pieces of evidence appearing in the Paper that would seem to indicate that a sine wave should be avoided and that they should seek to get a much steeper grunt or a sharper noise as this had a much better effect in attracting the attention of human beings. One of the pieces of evidence was that engine exhaust noises were on record as having carried considerably further than the fog signal they were operating. Another piece of evidence was that the grunt of the diaphone seemed to be very audible. He would like to know what were the reasons that prevented designers of signals aiming at a sudden, sharp shock in each of the noises that made up the series.

Another point of interest appeared on Page 90 of the Paper. There Mr. Tonkin pointed out that the mouths of the horns had been directed inwards in order to avoid the out-of-phase effect which would otherwise be produced at distant points. It was perfectly true that there would be a distinct out-of-phase condition at different points. The particular question relating to the phase of sound signals was one of considerable importance in telephony. Authorities stated that the phase of the components of a complex sound wave did not make any difference to the listening ear which had the ability to put them together again and make the correct signal. That referred to speech, but even when they were considering noise only, the statement was made that the phases of the components of the noise did not make any appreciable difference to the resulting sensation of noise. He would be very grateful to Mr. Tonkin for an expression of his views on that matter.

Professor J. Purser, M.A., M.A.I. (Honorary Secretary), seconding the vote of thanks, said that Mr. Tonkin had given them a very definite idea of the difficulties that were encountered in lifting and placing in position the heavy pieces of apparatus that were now in use in connection with the new signals at the Bull Rock. The lantern slides that accompanied Mr. Tonkin's Paper gave a pretty good impression of some of the problems confronting a lighthouse engineer. In the case of the Bull Rock the Commissioners of Irish Lights had undertaken big risks, but they had done so quite cheerfully, confident in the knowledge that anything Mr. Tonkin set out to do would be done as well as it possibly could be done.

Mr. Monaghan had referred to sound passing from the stage of mere audibility to that of being a painful sensation. He had had an experience of that type of sound last summer when he was within a few feet of a diaphone at Ballycotton and it went off unexpectedly. It was distinctly a painful sensation. It was of interest to note that the diaphone at Ballycotton was not by any means a powerful one. People living in the neighbourhood of Dun Laoghaire were aware of what quite a small diaphone could do in the way of producing noise. The one on the East Pier was very small, and had been removed from another station because it was not considered sufficiently effective.

Mr. Tonkin had devoted most of his attention to the siren on the Bull Rock, but he had also given a very interesting description of the submarine oscillator. One of these oscillators had been established outside Cork Harbour in the Daunt's Rock Light Vessel and it was coupled up with a radio transmitter. This combination gave not only the direction of the sound source by means of the ship's direction finding gear but also the distance of the sound source from the ship. The distance was measured by the difference in the times taken by the radio signal and the oscillator signal to reach the ship. At Cobh there was a sound signal in a small lighthouse in the middle of the Harbour. At present the signal was given by a bell, worked by a light keeper who lived in the lighthouse, but Mr. Tonkin was engaged on a scheme which would eventually control the sound signal from the shore. The signal—an acetylene gun—would be started and stopped automatically by means of a beam of light acting on a selenium cell which would be located in the lighthouse. In times of fog the light would be cut off from the cell and the change in the current of the circuit in which the cell was coupled would, after amplification, be able to start the acetylene gun. That represented another of the many duties undertaken by Mr. Tonkin.

There was one matter which Mr. Tonkin had not mentioned in the course of his interesting and instructive Paper and it might be of value to Engineers. He would like to know how did the range vary with the power input to the diaphone or siren.

Professor M. A. Hogan, D.Sc. (Member), said he thought the Institution was fortunate to receive a Paper dealing with a highly specialised subject which was somewhat outside the common experience of members of the Institution, and he was sure they were all very grateful to Mr. Tonkin for the detailed manner in which he had treated his subject. He had gone right to the kernel of it and had been most informative.

One could not but be struck by the way in which the design of the signals was based on the fundamental scientific principles laid down by Rayleigh years ago. Many engineers were concerned with the suppression of unwanted noise and, since the laws governing the generation and transmission of sound were the same, Mr. Tonkin's work might well be of value to power station designers and others who might strive after silence rather than sound. The Paper was of special interest because it dealt with one of the fields where engineering and physiology met and where the final success of the apparatus was dependent upon the human factor.

In discussing the relative advantages of different signalling systems, Mr. Tonkin had indicated the high efficiency of the submarine oscillator. He pointed out that the signals could be heard sufficiently clearly for the needs of small vessels up to a range of five miles or so without any special receiving apparatus. In view of that statement, the fact that many ships were not fitted with special receiving apparatus could hardly be counted as a serious disadvantage and the question arose as to why this system should not be employed in preference to the acoustic system. Because of the grave annoyance caused on shore by acoustic signals, it would seem desirable that efforts should be made to devise means of

*A Paper read before the Institution of Civil Engineers of Ireland and reproduced in the November and December issues of this Journal.

Navigational Fog Signals—continued

installing submarine oscillators at rock stations, particularly in the vicinity of thickly populated areas.

Mr. J. Mallagh, B.A., B.E. (Past President), said he thought Professor Hogan dealt with a very excellent point when he mentioned pure science; that seemed to him to be a very important factor as if they were to study navigational fog signals they required a very good knowledge of science.

The Author had given an indication that progress had been very slow in connection with the development of fog signals and it would seem that that slowness was due to some extent to the absence of proper research work. It could be said that Mr. Tonkin was very happily situated in having a Board which provided him with the sinews of war to do research work. In that respect he was greatly to be envied, though, perhaps, some of the people living in the neighbourhood of Dun Laoghaire might not agree with the recent experiment carried out there.

Professor Hogan made certain reference to the submarine oscillator and the ability of a ship to pick up the signal although not specially provided with a receiving apparatus. He would like to reinforce Professor Hogan's request for further information on that subject. They all recognised that fog signals caused much unpleasantness not alone on board ship but also on shore and, if the submarine oscillator was so efficient, would there be any possibility of getting rid of the present system of air signals and having instead a submarine system?

He thought it was a blot on the engineering profession to find that there had been no real experimental work on the subject of fog signals for thirty-nine years. In an island where the ocean highway ought to be properly delineated and guarded it did seem as if Irishmen had been rather lax in allowing such a long period to elapse without becoming really interested in such an important matter. One could scarcely over-estimate the importance of establishing an effective signalling system all around our coasts in order to cope satisfactorily with visitations of fog.

Mr. A. J. Litton, B.E., B.Sc. (Associate Member), said he was struck with the very low frequency that was used for the transmitter. He noticed that the difference in the transmission was between 600 and 200 cycles, or about 30 phons. If one plotted the sensitivity one would find there was a drop between 600 and 200 cycles of about 30 decibels. A certain advantage would appear to lie with the lower frequency, although he was inclined to think that he might be wrong on that point.

Interesting references had been made by Mr. Monaghan to the masking effect of the lower frequencies. An important point had been raised with regard to the phase aspect. He thought there was a difference between the phase of the individual sounds in speech and the phase of the transmitting sources in the case of a signal. He wondered if there was a beacon which radiated on the same principle as the modern lighthouse. It would probably make for a more even load factor and at the same time he felt that it would economise in apparatus.

The Author had referred to the great difficulty experienced in getting a sine wave. It occurred to him that if one had the ports at an angle to the axis it would help to improve the wave form and it would have a somewhat similar effect to similar windings on the armature of an alternator. One method of improving the wave form was to have the ports at an angle to the axis. He was wondering if that system could be applied to the siren. It might, too, be an advantage to have certain harmonics.

He would like some expression of opinion from Mr. Tonkin with reference to an experience which he felt had also been shared by other members of the profession. When approaching a fog gun in a ship he noticed that at one moment one could hear the gun quite distinctly and then for a short period it would be quite inaudible and later it could be easily picked up again. He believed that it was quite common for mariners to lose the signal for short periods of time. No doubt it was due to some atmospheric peculiarity, but perhaps Mr. Tonkin might have a definite opinion about the matter.

The President, conveying to Mr. Tonkin the vote of thanks, which was passed with acclamation, said he would like to emphasise the great debt of gratitude which the Institution owed to Mr. Tonkin for the very valuable Paper which he presented to them. In the Paper he had dealt with a most complex subject in a thoroughly capable manner. There could be no doubt that the Paper on Navigational Fog Signals would be found exceedingly useful and valuable: it was a decided acquisition to the Transactions of the Institution.

As President of the Institution, he desired to extend a welcome to Mr. Tonkin, who had just been elected a Member. They felt honoured by his coming amongst them and they sincerely hoped that this would be the first of a number of Papers which he would submit for their entertainment and education.

REPLY.

Mr. J. W. Tonkin (Member), said that as regards the point raised by Mr. Monaghan with reference to the best pitch for the note, he did not think it was in any way certain that 128 vibrations would be better than 256; perhaps the best frequency would be obtained between the two. At any rate, it should not be lower than 128 and if there were any change, it should be towards a higher note. There was nothing to be gained by nibbling at the thing. It would be a question of doubling or even quadrupling and not adding a mere 10 per cent. It was quite possible that 256 would give a better signal; it definitely would be better when there was a noisy background, but it would not be quite so good when things were quite silent.

Long ago Professor Tyndall stated that foggy weather was the best weather for the transmission of sound. That was rather doubtful. He was of the opinion that some kinds of fog did stop sound.

With regard to the sine wave, he thought the only advantage that the sine wave had was that it gave the greatest amplitude for the least expenditure of energy. Certain authorities claimed to have produced a sine wave.

Mr. Monaghan mentioned the grunt in the diaphragm. That was due to the frequency of the sound produced by the piston being in harmony with the fundamental note of the trumpet. Naturally when the piston ran at a frequency corresponding to the note of the trumpet, they obtained the best possible note. It was not easy, in fact, it was practically impossible, to continue sending at the best frequency of the trumpet, the control was so delicate. Then again, there were variations in the length of the trumpet caused by changes in atmospheric temperature.

As far as the phasing for pitch was concerned, if there were two sounds out of phase the ear would not be misled. If there were two sounds of the same frequency, one in front of the other, the ear would determine the pitch of each separate sound. If one could get two sounds exactly in phase, they could hardly be in phase without increasing the amplitude. Two visible waves in phase in water would increase the amplitude, no doubt. He thought it was highly probable that they would do the same thing in sound.

Professor Purser asked how the power of a signal varied with the input. In an instrument without any designed acoustic interference it varied approximately as the cube root of the input, but he thought that in the new Bull Rock sirens it varied as some rather lower power.

In reply to Professor Hogan Mr. Tonkin said one could hear a submarine signal when below the water level in a ship. If one were on the bridge one would be very unlikely to hear anything water borne.

Professor Hogan had asked about receiving submarine signals instead of air borne signals. That could be done in many places but it was not infrequently the case that the man who saw a light or heard a signal was not expecting either. That was the advantage of having things like lights and fog signals.

Mr. Mallagh spoke about the slow development of the siren. He did not mean to convey in the Paper that there had been no research in thirty-nine years. There had been research, but lighthouse engineers were not very favourably placed for research work because before one did anything one required to have the funds and before one could get the funds people would want to know what results were going to be achieved, actually before one started. He did not agree with Mr. Mallagh that the lighthouse people were in an enviable position. They were not; they were subject to financial control and the people who kept the purse strings were not technical people at all.

Mr. Litton talked about the low frequency and thought that an advantage lay there. Mr. Litton also raised a point about the rotating beacon. He was not quite sure whether Mr. Litton meant a rotating siren trumpet or a radio beacon. There was a rotating radio beacon, a rather wonderful thing by which one could get directions with an ordinary receiving set and a stop watch. On the subject of overtones, he thought one would get better value for one's money if one piled all the energy into a main note.

With regard to a silent zone, that was one of the worst features of all air-borne signals. He did not think there was any possibility of doing away with it. It cropped up at certain places and it seemed to be fairly fixed in some cases. It was largely due to the contour of the land. There were on the coast one or two places where there was a most marked change—one would go from full audibility to complete silence in a short distance. The only thing that could be done about a silent zone was to increase the power. He thought if there was a prolonged note it would be an advantage and would be more likely to get over a silent zone than was a gun.